

# T E R R A

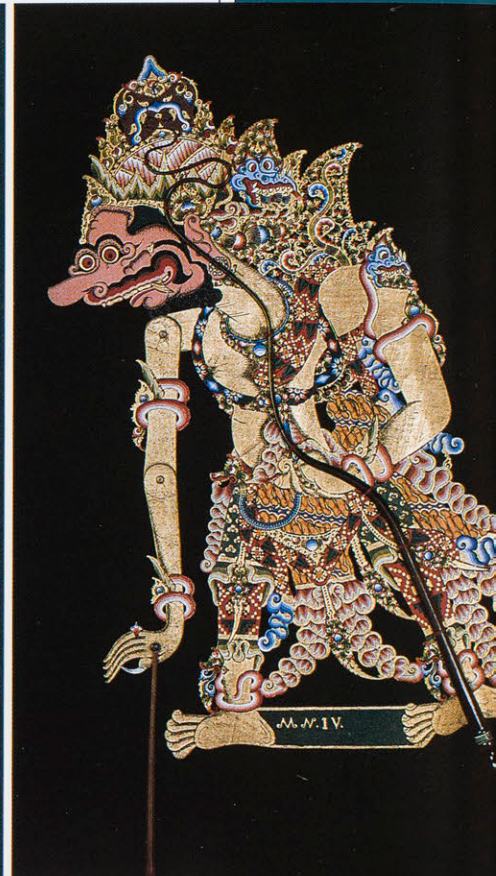
MAGAZINE OF THE  
NATURAL HISTORY MUSEUM  
OF LOS ANGELES COUNTY

VOLUME 30, NO.1  
FALL 1991





# COURT ARTS OF INDONESIA



Photographs: John Gollings

*An exhibition at the*  
**Natural History Museum  
of Los Angeles County**  
October 19, 1991 to January 5, 1992

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COVER: Topeng (mask), Panji, 19th century. Central Java. Kantil wood, natural pigments, 24-carat gold leaf, fish glue medium, leather teeth-thong. Prince Panji embodies the Javanese ideal of the noble prince, often compared to Arjuna, hero of the Hindu epic Mahabharata. Collection of K.R.T. Hardjonagoro. Photograph by John Gollings.

# TERRA

THE NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY  
VOLUME 30,  
NO. 1

FALL  
1991

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# Museum on the Move

## NEWS

### ■ MOLECULAR APPROACH TO COLLECTIONS

Genetic molecules have been successfully taken from a dried museum fungus specimen that was collected 96 years ago. Natural History Museum Botany Associate Eric Swann of the University of California, Berkeley crushed spores from two rust fungus species for their functional DNA. The minute samples will be increased several million times, using special molecular technology. The DNA's genetic code from *Phragmidium ivisiae*, along with that of a specimen of *Phragmidium acuminatum* collected 58 years ago, will be read to classify and to gauge the evolutionary and taxonomic relations of these and other fungi that cause plant diseases.

This molecular approach to studying the museum's collections of plants and animals will be used in the proposed new Biochemical and Molecular Systematics Laboratory.

### ■ SEAVER CENTER MANUSCRIPTS GO ONLINE

The Seaver Center for Western History Research has a large number of individual manuscript items that are valuable sources for scholars researching American, especially Western, history. These items come in a variety of forms including letters, diaries, speeches, marriage licenses, and copy books.

In order to make these valuable documents more accessible to researchers, the Seaver Center staff has begun cataloging them using the international Online Computer Library Center (OCLC) system. Once a catalog record is entered on OCLC, researchers all over the United States, and in a few other countries, are able to learn of the Seaver Center's holdings.

Most of the materials in the Seaver Center's Manuscripts File date from the mid-19th to the early 20th century and cover a wide range of topics, including mining, education, religion, clubs and societies, and westward journeys, among others. Many of the personal letters, diaries, and essays provide information on local communities in California.

The creators of many of these manuscripts were people who never gained fame, but whose records are extremely valuable in reconstructing the lives of ordinary people. There are also, however, many documents by people whose names we easily recognize, including Susan B. Anthony, Frances Willard, William T. Sherman, Robert E. Lee, Jefferson Davis, and Franklin Delano Roosevelt and other United States presidents. Local personalities represented in the collection include Pio Pico, Antonio del Valle, and James B. Lankershim.

### ■ AMERICAN INDIAN FESTIVAL A SMASH

The 19th annual American Indian Festival and Market, which was held at the museum during the weekend of March 22, 23, and 24, 1991, marked a major step in the event's continuing growth. The number of participating artists increased from 24 to 40, thereby offering a greater selection of quality works. Artists' sales totaled \$160,872, up 60% over the previous year. Attendance also rose significantly, as did income from related activities such as museum stores, admissions, parking, food services, and membership sales. The American Indian Festival and Market is now the largest annual event at the museum, and the only event on the West Coast that brings together so many of the top names in American Indian art in one place at one time.

The festival's expansion was achieved through the fundraising

efforts of museum board members who demonstrated their support of the event by meeting a challenge grant from the Ledler Foundation. Special thanks are due to Barbara White-Thomson, who secured the lead gift from U.S. Borax and Chemical Corporation, and to Gloria Stewart, who made a generous personal gift.

## GRANTS

### ■ MAXWELL H. GLUCK FOUNDATION SUPPORTS

**EDUCATION OUTREACH** The Education and Exhibits Divisions have received a grant from the Maxwell H. Gluck Foundation for \$1,002,203 to create the first science outreach program of its kind in the country. The program will include an exhibit that will travel to Los Angeles Unified School District schools over a three-year period.

The project, tentatively entitled *The Earthmobile*, will be housed in a specially modified tractor-trailer. It will contain a simulated archaeological dig and field laboratory that will be used with directed activities to examine the impact of humans on the natural world. A visit from the *Earthmobile* will include supporting materials and activities before and after the exhibit's visit.

The project will add two new museum positions and is a collaboration among the museum's Education and Exhibits Divisions, the Los Angeles Unified School District, and outside consultants. It is scheduled to be in the schools in the fall of 1991.

## ACQUISITIONS

■ **HISTORY DIVISION ACQUIRES MAUDE PHOTO ALBUM** The Seaver Center for Western History Research has recently acquired an album of 33 original



Barbara White-Thomson, museum trustee, Ray Tracey, Navajo artist, and Shelley Stephens, festival organizer, at the evening preview of the American Indian Festival and Market.



prints of the California missions. The photographs, which date from the 1890s, are the work of Frederic Hamer Maude, a Los Angeles landscape photographer who was active at the turn of the century. The album is a welcome addition to the Seaver Center's collection of Maude prints and negatives. Errol Stevens, head of the Seaver Center, will use the album in his research for a book about photography and tourism in the Southwest.

"Los Angeles photographers helped create a new image of southern California in the minds of Eastern tourists," says Stevens. "Maude's work is an excellent example of the kind of promotional photography done in California at the end of the 19th century."

The album, which was purchased with acquisition funds from the Natural History Foundation, will be available for use in exhibits and to researchers who use the Seaver Center.

## DEVELOPMENT

### ■ SPECIAL TAX DEDUCTION FOR 1991 DONATIONS

An op-

portunity exists for both the Natural History Museum and its supporters to benefit from the Revenue Reconciliation Act of 1990. Contributions of artifacts, materials, objects, or specimens to the Natural History Museum are, *for taxable year 1991 only*, deductible up to the fair market value of the property for both regular and alternative minimum tax purposes, subject to percentage limitations. Donations must be "tangible personal property" and must fit the museum's tax-exempt objectives. Securities and parcels of land are not acceptable, but manuscripts, furniture, works of art, costumes, artifacts, and other collectibles are. Your tax advisor can provide further information on how this special one-time opportunity could affect your taxes.

The museum's divisions are seeking select items in the following areas:

■ **HISTORY:** The General Americana section seeks artifacts relating to the professions and trades, community and domestic life, and personal effects of Californians from European contact to the present day. The Seaver Center for Western History Re-

search seeks manuscripts, diaries, historical photographs, rare books, and ephemera about the West. The Transportation and Communication section seeks antique automobiles, wagons, carriages, and streetcars, as well as vintage cameras and other photographic equipment. The Conservation section would like to have working microscopes and other scientific equipment to assist in furnishing the new conservation laboratory.

### ■ EARTH SCIENCES:

Gemstones, minerals, fine jewelry or gem carvings, works of art using gem materials, unusual or period jewelry containing significant gemstones, and other examples of fine, unique, or unusual objects are of interest. Vertebrate fossils are of potential interest, but they must have good documentation including geographical and geologic data associated with them.

■ **LIFE SCIENCES:** The Anthropology section seeks to add to its ethnographic collections from Africa, Oceania, and the Americas. Anthropology especially seeks a few strong pieces to add to its



growing collection of contemporary Native American art.

Call the Development Office at 213/744-3307. Your gift is greatly appreciated by the museum and by the future generations who will benefit from it.

■ **NEW FELLOWS** The Fellows began the new year with a January celebration marking the opening of the Ralph W. Schreiber Hall of Birds. In February, they learned how to preserve precious heirlooms while enjoying tea and scones in Elaine Leventhal's Bel Air home. In March, museum curator Dave Whistler led the Fellows on a fossil hunt in Red Rock Canyon in the Mojave Desert, while another group set aside gulf war travel fears to journey to Indonesia with Dr. Dan Cohen, Life Sciences Chief Curator, and U.S.C. anthropology professor Dr. Steve Lansing. To samba music and a Brazilian feast, the Fellows enjoyed an account by Joe Kane of a unique adventure: navigating the entire length of the Amazon River, including run-ins with Shining Path guerrillas, in a kayak (Kane was the first American to accomplish this). The Fel-

lows also spent a beautiful spring day in April in the Santa Monica Mountains with curators Art Evans and Dave Whistler.

May brought three interesting events to Fellows' calendars, including brunch at Diana and David Jacobs' Biota Gallery on Melrose, a trip to General William Lyons' private automobile museum and an opportunity to meet Honorary Fellow Rick Ridgeway and hear about his 18,000 foot climb up Mount Everest.

We are very pleased to welcome the following Fellows who joined between January 22, 1991 and June 20, 1991:

- DR. JO ANNE BRASEL  
MR. AND MRS. MAURO CICCCHINE  
MR. DONALD W. MCNAMEE  
MR. AND MRS. WILLIAM H. TILLEY  
MR. AND MRS. JEROME ZERG  
MR. MICHAEL CRICHTON  
DANNY DEVITO AND RHEA PERLMAN  
FRED AND BARBARA KORT

■ **BUSINESS ASSOCIATES** The museum would also like to welcome new Business Associates Johnson and Higgins and Ticketmaster Corporation.

Our Business Associates and other corporate donors find that it makes good business sense to entertain at the Natural History and George C. Page museums. In recent months, MetLife celebrated the signing of a major contract, Carsey-Werner Company and Financial Indemnity Company held holiday parties for their employees, and First Interstate Bank arranged a dinner dance to open a conference for senior executives. To schedule an off-site meeting of your Board, a very special business luncheon, or a memorable evening event at the museum, contact Maggie Walsh at (213) 744-3307.

MEMBERSHIP

■ **SCHOOLTEACHER TAKES FLIGHT** On April 21, as part of the "Celebration of Birds" festivities, a drawing was held to give away airline tickets for summer travel. The winner was Dawn Lakowski, a middle school teacher in Long Beach. She and her husband will take a most welcome getaway trip generously donated by Alaska Airlines.



San Juan Capistrano Mission, ca 1890.  
From the Seaver Center's newly acquired  
Frederic Hamer Maude album.



# Courtly Arts of Indonesia

by J. Stephen Lansing

**I**N 1975 I MOVED INTO A FEW ROOMS IN the ruins of the Balinese palace of Sukawati, to gather materials for a doctoral dissertation in anthropology. In the eighteenth century, Sukawati was one of the most prominent "little kingdoms" of Bali. But it was decisively defeated by a rival kingdom in the late nineteenth century, and in 1975 the only visible remains of its ancient glories were the remnants of the palace and an adjacent empty temple dedicated, I was told, to the ancestors of the royal family. One afternoon, I returned from a trip to find the royal temple crowded with hundreds of people in festival dress, decorating the shrines and preparing an antique gamelan orchestra and stage for an evening of performances. A steady

stream of people were arriving, some on foot from the village, others from farther away in trucks and buses and on bicycles. Eventually I located a friend who explained the identity of the worshippers: most of them, apparently, were descendants of former subjects of the kingdom of Sukawati. I remembered that according to the Balinese religion, most people are reincarnated into their own families after five or more generations, as their own descendants. As evening fell, *Topeng* (masked) dancers retold stories from the court chronicles of Sukawati in the central court of the temple, while in the inner sanctum Brahman priests spoke Sanskrit prayers to the shades of the ancient kings. Occasionally a dancer would fall into a trance, his spirit temporarily possessed by a

ghost from the splendid past. In this way, for a day and a night, the vanished kingdom of Sukawati reappeared in the old temple, to disappear just as suddenly the next morning, as the descendants of princes and warriors returned to their contemporary villages.

It was this apparition of a ghostly kingdom that came to mind when I was asked to write about the continuing importance of the courtly arts in Indonesian culture. As Westerners, we are likely to think of "courtly arts" as belonging to an aristocratic society of long ago. But in societies like Bali, the boundary between the world of the courts and the world of ordinary people can be more fluid, and even the boundary between past and present may not be



OPPOSITE TOP ►

A performance of gamelan music at a Balinese temple festival. The drummer (foreground) conducts the orchestra, and the melody is carried by the flutists on the drummer's right. Eleventh century copper-plate inscriptions issued by Balinese kings ask villagers to help pay for the performances of roving orchestras, including flutists and drummers. Photograph by Thérèse de Vet.

Complete wayang kulit kotak set up for performance by the dalangs (puppeteers) in the Kraton (palace) of Ngayogyakarta Hadiningrat, Yogyakarta, 1989. The kayon (tree of life) puppet, which opens every performance, is visible at the center of the wayang screen on the far left. The puppets visible on the right of the screen are demonic characters; on the other side of the screen are the heroes. The principal puppeteer is seated in front of the screen, where he will receive the puppets handed to him by his assistants. As well as moving the puppets and giving voice to them, he must also control the orchestra, in performances which last for hours.







A procession of worshippers, descendants of the former Balinese kingdom of Sukawati, accompanies a palanquin containing votive figures of the local gods in a procession around the temple. Those who regard themselves as direct descendants of the god or his servants are permitted to carry the palanquin, or hold aloft the white cloth trailing behind it. Photograph by the author.

TOP RIGHT

A palanquin carrying a votive figure of a deity in a procession to a temple festival in Bali. Most of the time, Balinese temples are thought to be empty. The gods are invited to descend into the temple for a specific period, usually one to three days, to receive the prayers, offerings and artistic performances of their worshippers. Photograph by the author.

OPPOSITE ►

Topeng (mask), Klono (?), late 19th century. Kutei, East Kalimantan. Wood, pigments, gold leaf, fish glue medium, diamonds, hair. Although the mask has a crown and is white, both features that could indicate nobility, the protruding eyes imply a coarse character. Museum Nasional, Jakarta.



immutable. A few months after the royal temple festival at Sukawati, I was going through the papers of the colonial archaeologists who conducted the first surveys of Balinese sites, a few years after the Dutch conquered Bali in 1908. Even before the conquest, Bali had gained a reputation among European scholars as a place where certain ancient traditions of Hindu-Buddhist civilization had continued to flourish, long after they had disappeared elsewhere. Among the papers in the Archaeological Museum of Bali was a report by a well-known Dutch archaeologist, Dr. W. F. Stutterheim, describing an incident that occurred while he was investigating a tenth-century shrine:

Not far from Tampak Siring, which has acquired a certain fame among tourists owing to the so-called "king's tombs" situated there, lies the very holy watering-place Tirtha Mpul. Exploring the vicinity, I found a short distance away, in a village named Manukaya, a much weather-worn inscription on a stone. None of the Balinese could decipher the old engraved letters, nor were the contents of the inscription known to anyone. The stone stood there, as every villager of Manukaya knew it from childhood, wrapped in a white cloth and provided with regular offerings. I was told, however, that on the fourth month of every year, at the full moon, this stone (which is also said to have fallen from the sky) is carried to the holy waters of Tirtha Mpul and bathed therein — much to the detriment of the stone, by the way, which is a big slab of soft tufa covered as usual with a thin layer of cement.

Deciphering the inscription, I found that it was none other than the charter of Tirtha Mpul's

foundation, made in the fourth month, at full-moon day, in the year 962 A.D. Thus the people have kept alive the connection between stone and watering place for almost one thousand years, and have always celebrated its anniversary on the correct day, but of the true meaning of this connection every recollection was lost. I need hardly add that the communication of my findings was received in the place with no little interest.

The villagers could no longer read the inscription on the stone because over the course of the millennium since the creation of the royal bathing pools, the Balinese language had slowly evolved to the point that the words and even the letters of the inscription had become so arcane as to be unintelligible.

For us, experiences like this — when a weather-worn stone or a temple festival suddenly becomes a window into the depths of time — may seem merely curious. But such experiences are actually connected to the wellsprings of art, according to an ancient tradition of aesthetic philosophy that flourished in the courts of Central Java a thousand years ago. Indonesian courts of the first millennium A.D. drew much of their inspiration from the artistic culture of India, where art was sometimes described as a yantra,

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*The "courtly arts" of Bali were not actually restricted to the courts, but traveled along an axis between the courts and the villages*

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or vehicle of knowledge. In ancient religious texts, the arts were celebrated for their ability to startle an audience into a deeper or more profound appreciation of the nature of reality. This idea was given eloquent expression in some of the earliest poetry written in Indonesia, composed in the Hindu/Buddhist courts of central Java beginning about the ninth century A.D. These poems were written in the Sanskrit alphabet, in a language now known as Old Javanese. Each poem begins with an invocation to the god or goddess of beauty (*alangö*). *Alangö* is said to be the foundation of the world, all-pervading but invisible because it has a finer texture than the visible world. *Alangö* is immaterial (*niskala*), yet it pervades everything "from the coarse to the fine" (*aganal alit*). One poem begins by invoking the god of beauty who is "concealed in the dust of the pencil sharpened by the poet before he begins to write." The god is asked to descend into the letters of the poem as if they were his temple. The god of beauty is said to be the ultimate foundation of all that exists, and also its real essence, an essence that can only be grasped with the help of the arts.







A young boy is held as he begins to emerge from a trance, in a Balinese temple festival. Trance states are highly valued, as signs that the worshipper has been able to pierce the veil of illusion (*maya*) which ordinarily hides the transcendental world of the gods from our view. Even a violent trance state can usually be terminated by a few prayers and drops of holy water, administered by a temple priest. Most people are exhausted by the experience; with luck they may experience a feeling of catharsis. Photograph by the author.



Telek (mask), 20th century (?). Bali. Pole wood, fish glue patination. The mask is worn by female dancers in performances which pit the Barong, representing the powers of human innocence, against the malevolent demoness Rangda. At the climax of the performance, many dancers and onlookers may fall into trance and attack Rangda. Museum Bali, Denpasar.



Obviously, the English words "god" and "beauty" are imperfect translations of this concept. After a brave attempt at translation, the great Dutch scholar P.J. Zoetmulder threw up his hands with the remark that translators "must resign themselves to the fact that Old Javanese is exceptionally rich in this area of description, and has developed a variety of means of expressing aesthetic emotion which other languages do not possess." Yet some of Zoetmulder's translations evoke images of a subtle essence connecting the soul to the phenomenal world, as in this excerpt from the fourteenth century poem *Sumanasantaka*:

When a woman wishes to die, she asks the gods to return her beauty to the month of Kartika; the loveliness of her hair to the rain-bearing clouds . . . her tears to the dew-drops suspended from the tip of a blade of grass

The same poem describes the waves of the sea as a "flight of crystal stairs down which the poet descends when in old age he ends his life by plunging into *langö*." The "forest feels dejected in the month of Asadha," according to another poem, "because its chill makes poets shiver and even sick from the cold." Sculptural friezes along the sides of fourteenth century East Javanese temples show court poets writing poems not only on manuscript leaves, but also sometimes on living leaves or flowers. Courtly ideals of love and beauty were enriched by a metaphysics that portrayed art as a vehicle for penetrating the veil of illusion (*maya*), to gain a more profound understanding of the world.

That these ideas about the importance of art were more than merely poetic conventions is indicated by a second body of literature: the royal inscriptions or edicts that kings issued to villages, many of which have been preserved because they were often inscribed in stone or metal, like the golden letter from a Balinese king in the Courtly Arts of Indonesia exhibition at the Natural History Museum of Los Angeles County. For example, the earliest known royal inscription from Bali is a royal charter instructing mountain villagers to establish a "refuge for people traveling in groups back and forth over the mountains." Much of the inscription is evidence of the king's interest in the support of the arts. Traveling musicians and actors are exempted from taxes, while royal performers are entitled to collect fees in the king's name. In later inscriptions, Balinese kings show an even more intense interest in the support of the arts. Flute-players, clowns and dancers, drummers, puppeteers, actors and musicians are given the right to collect fees in the king's name when they practice their arts in the countryside. The inscriptions distinguish between artists who are permanent residents of villages, "traveling players," and "performers who may perform before the king." Based on these inscriptions, it appears that the "courtly arts" of Bali were not actually restricted to the courts, but traveled along an axis between the courts and the villages.

The arts were also important in maintaining cultural links between courts, sometimes across vast distances. An inscription from the eighth century A.D. found at the great Indian Buddhist university of Nalanda records the gift of a new monastery by a Javanese king of the Sailendra dynasty, whose kingdom was located thousands of miles from Nalanda:



"With his mind attracted by the manifold excellences of Nalanda . . . and having realized that riches were fickle like the waves of a mountain stream, he built there at Nalanda a monastery . . . white with lofty dwellings. As long as the ocean exists, and as long as the Eastern and Western mountains have their crest jewels scratched by the hooves of the horses of the Sun, so long may this meritorious act endure."

Along with the inscription, archaeologists found small bronze statues identical to others found in the ruins of the Javanese palace. Evidence of the fruitfulness of such contacts is provided by sculptures like the portrait of Kertarajasa, founder of the great Majapahit dynasty in Java, in an Indian style.

Of all the courtly arts of Indonesia, perhaps the most intriguing is the art of shadow puppetry, or *wayang*. *Wayang* is mentioned in some of the oldest inscriptions from both Java and Bali, and continues to be one of the most popular art forms today. On first acquaintance, *wayang* appears to be a quintessentially aristocratic art form: several hundred painted leather puppets portray the gods and goddesses, heroes and heroines of classical Hindu mythology. The puppeteer retells stories from the classical literature, such as the epic poems Mahabharata and Ramayana, in performances which last for hours, sometimes until dawn, to the accompaniment of classical *gamelan* music. Performances of this kind are an indispensable part of most important courtly festivals and rituals in Java and Bali, and a connoisseur's knowledge of *wayang* is essential for

any Indonesian aristocrat. (The exhibition at the Natural History Museum includes a splendid array of *wayang* puppets, showing clear regional differences in their form and style.)

Yet today, as in the past, *wayang* performances are as popular in the villages as they are in the royal courts. To understand the popularity of *wayang*, one must realize that it is much more than a way to retell ancient Hindu myths. Perhaps more than any other Indonesian art form, *wayang* exemplifies the ancient idea that art is a yantra, a tool for the mind, which can pierce the illusions of an unreflective life. *Wayang* puppeteers must not decide on the story they will tell until they have assessed the reasons for the performance, and the needs of the audience. Here is Wija, a modern Balinese shadow puppeteer, in an interview with the American storyteller Diane Wolkstein:

Wolkstein: How do you choose which story you will tell?

Wija: It is always different. Before the performance begins we are served coffee and tea by the commu-



Dirk Bakker

Ear pendant in dragon form, 14th-15th century. East Java. Gold. This exquisite dragon dates from the age of the last great Hindu kingdoms of Java. At the beginning of the 16th century the Hindu kingdom of Majapahit was defeated, and Hinduism disappeared from Indonesia except for the island of Bali. Royal Tropical Institute, Tropenmuseum, Amsterdam.









nity or the people who have asked for the *wayang*. I talk with the people. Very often those who have sponsored the *wayang* will ask for certain things to be stressed.

Wolkstein: If you go to a village where there are problems, do you try to solve them?

Wija: Of course! That is my job! The *wayang* reflects our life . . . Just as the Pandawas [heroes of the Mahabharata] are always being tempted by the Kauravas, their enemies, we too are always being tempted by evil. By taking the shadows of the *wayang* into ourselves, we are strengthened by the struggle, and the victory of the Pandawas. The clashing of the swords and the heaving of the divine weapons is only the outer image of the internal battle.

The word *wayang* is usually translated into English as "shadow," but "reflection" might be a better translation, as in Wija's comment that "*wayang* reflects our life." In a performance, the puppeteer is seated behind a cloth screen, which is illuminated by the flickering light of an oil lamp. As the *wayang* begins, the puppeteer holds the Tree of Life (*kayon*) puppet to his forehead, closes his eyes and "calls the gods to their places," for the gods of the outer world



◀ OPPOSITE

Manuscript of Dewa Ruci, 1886. Yogyakarta, Central Java. Ink on European paper, polychrome watercolor, gold leaf, leather binding. The popular tale of Dewa Ruci concerns the search for the water of life by the Pandawa warrior hero Bima. National Gallery of Victoria, Melbourne.

TOP

A Balinese Brahman scholar reading from a lontar leaf manuscript, which he has just finished writing. The letters of the poem were incised into the lontar blade with the small knife seen in the foreground. The Balinese written alphabet derives from Sanskrit Pre-Nagari, which reached Indonesia in the second half of the first millennium A.D. Today the entire heritage of classical Indonesian literature is kept alive as a living tradition only in Bali. Photograph by the author.



Lontar manuscript of Smara Dahana, second half of 19th century. Singaraja, North Bali. 34 folios on palm leaf (lontar), 33 incised and inked, 2 also polychromed and gilded, wood with polychrome decoration; string and coin. A Balinese manuscript of an Old Javanese kakawin, a poem written in Indian meter by the court poet Dharmaja, probably in the second half of the twelfth century. The poem, called "The Burning of the God of Love", relates the story of the creation of the elephant-god Ganesha by Siva and Uma. Because the lontar leaves eventually disintegrate in the tropical climate, such poems must be painstakingly recopied at least once every century. Collection of Peter Worsley.



A thousand year old stone sculpture of a Hindu goddess pouring water into a bathing pool, dating from the same era as the royal Balinese bathing pools of Tirtha Mpul whose charter was translated by the Dutch archaeologist Stutterheim. At this early date, the sculpture is still recognizably Indian, showing little trace of the Balinese stylistic features that emerged in later centuries. Goa Gajah, Bali. Photograph by the author.



BELOW

Portion of a jajan bumi ("world-offering"), the most elaborate of all perishable Balinese festival offerings. The heads of the same two serpents, Anantabhoga and Basuki, seen in the wahana on page 15 are visible at the bottom left and right. Above them two worshippers, male and female, pray to a god while in the upper corners two dedari (angels) look down. The entire offering is made of edible rice flour, and is intended to last only as long as the gods are present in the temple. Photograph by the author.



OPPOSITE ►

Wahana (miniature vehicle for a votive figure), 20th century. Bali. Wood, pigments, gold leaf, fish glue medium, lacquer. The Wahana is used to carry an effigy of a deity, called an arca lingga, in ceremonial processions around the temple grounds, or on journeys to other temples or to the sea. The deity is invited to descend into the arca for the duration of a temple festival, to receive offerings and witness artistic performances in its honor. The lid of the box is surmounted by two crowned serpents carried on the back of a turtle. This evokes the legend that the island of Bali rests on the back of Bedawang Nala, the Underworld turtle held between the coils of two serpents, Anantabhoga and Basuki, who encircle the world. The tigerlike beast crouched on the serpent's backs probably represents the forces of evil. Collection of the Australian Museum, Sydney.

or macrocosm (*buana agung*) are also thought to exist in the inner world of the self (*buana alit*). The relationship between the inner and outer worlds is also reflected in the puppets themselves: they are richly painted, but during a performance they appear on the audience's side of the screen only as shadows, suggesting that the world of the gods is so brilliant as to be beyond human sight or imagination. The *wayang* screen is in one sense a window that allows us to peer out of our world of illusions into the dazzling world of the gods, for whom *we* are monochromatic shadows. In special *wayang* performances held for the gods alone, without a human audience, the screen is not used. The myths and legends must be told by puppets speaking accurate Old Javanese (which has become a purely literary language); the sounds of their voices, enhanced by music from the gamelan orchestra, are thought to be intrinsically powerful. On the "Mountain of Poets" (*Gunung Kawi*) in East Java, a *wayang* performance goes on continuously, day and night, sometimes with an audience but often not. The performance itself is thought to create an island of order in the world, as in the story of the rampaging giant who was finally quieted by the sight of a *wayang*, which drew him in and made him cease his random violence.

The structure of the *wayang* performance creates a rich metaphor of inner and outer realities. The puppeteer creates a world of pure illusion, of shadows and sounds, which paradoxically is also the 'real' world. Each audience — the gods and the human spectators — appears as a mere shadow to the other. The gods who inhabit the outer world are also thought to exist in the inner world of the self. Thus a puppeteer animates the gods, who in another sense animate him. These paradoxes are fully exploited in the *wayang*.

The proper task of a puppeteer is not to mystify with illusion, but rather to clarify the role of illusion in our perception of reality. For this reason, puppeteers are also priests, and the performance itself is simultaneously art and a religious ritual. In contemplating a *wayang*, one sees that the boundaries between inner and outer realities — imagined worlds, the world before our eyes, and the worlds of the past and present — are forever shifting and in flux. One of the worst-kept secrets of the *wayang* is the identity of the chief clown, called Twalen in Balinese and Semar in Javanese. Semar is represented in the exhibition by several images, among them a robust Javanese *wayang* puppet, which portrays him as the prince of fools, a fat Falstaffian buffoon who plays the role of servant to the godlike Pandawas in the *wayang*. But in reality, as the audience knows, Semar is the elder brother of Siva, greatest of the gods, and is thus older and more powerful than all







Wayang kulit, Semar, 19th century.  
Cirebon, West Java. Buffalo hide  
parchment, pigment, gold leaf, fish glue  
medium, buffalo horn, metal studs.  
Semar, the clownish servant of the  
godlike Pandawas, is said to have a secret  
identity: in reality, this aged peasant is  
the elder brother of the supreme god

Siwa, and is thus older and more  
powerful than the gods themselves. This  
example from Cirebon has a movable jaw,  
which helps him steal the scene when he  
cracks jokes in shadow-puppet  
performances; he also wears heavy wrist  
bracelets and an ornamental headdress  
(sumping). Kraton Kasepuhan, Cirebon.







the gods. In Indonesian mythology, he is also sometimes portrayed as a wise old farmer, quietly tending his rice terraces in the age before the birth of the gods. Semar and the other clowns exist outside of time; for them, the magnificence of the courts and the adventures of kings are a spectacle to be relished, a past to be conjured up in a performance, like the annual festival of the vanished kingdom of Sukawati.

Steve Lansing's most recent book about Bali is *Priests and Programmers: Technologies of Power in the Engineered Landscape of Bali* (Princeton University Press, 1991). He was born in Ann Arbor, Michigan in 1950 and is currently professor and chairman of the Department of Anthropology at the University of Southern California.

Photographs of artifacts courtesy of The Asia Society Galleries, New York. All photographs of artifacts are by John Gollings, except where noted.

*The Court Arts of Indonesia* exhibition at the Natural History Museum was organized by The Asia Society Galleries, New York.

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Dance crown, 1920's. Surakarta, Central Java. Gold, diamonds, velvet and cotton ribbon. This crown is one of nine made for dancers at the instigation of Mangkunagoro VII, ruler of the Surakarta court and a noted patron of the arts. The bedoyo is one of the oldest court dances of Java, traditionally performed by royal princesses and seen only by the members of the court. The headdress and diadem of the crown resemble those on temple bas reliefs and sculpture of the last great Javanese Hindu kingdom, which fell in 1515. The style of the gold work is a replica of the original crown of Cirebon. Istana Mangkunagaran, Surakarta.



# Island Foxes

## A MODEL FOR CONSERVATION GENETICS

by Sarah B. George and Robert K. Wayne

IT'S LATE IN THE AFTERNOON ON SANTA Cruz Island. We've had a long day running traps and are nearing the end of our trapline. An old female fox is lurking in the scrub near the trap station. She has just succeeded in robbing this trap, not once, but twice, without triggering the door mechanism. She watches carefully as we bait our cage trap again with generic, fish-flavored cat food. Six of us back away while Niles lifts the door and stands motionless over the trap, waiting. After a few minutes of cautious circling, the fox moves slowly into the trap and Niles drops the door shut . . . caught her!

The seven of us are Robert Wayne, Blaire Van Valkenburgh, and Niles Lehman from UCLA, Paul Collins from the Santa Barbara Museum of Natural History, and Sarah George, Jesus Maldonado, and Rick Ford from the Natural History Museum. The old female is a Channel Island fox, *Urocyon littoralis*, a species that is a diminutive relative of the gray fox of mainland California. The island fox is about  $\frac{2}{3}$  the size of its mainland cousin, *Urocyon cinereoargenteus*, but it is otherwise similar in color and appearance. It is found on six of the California Channel Islands, including Santa Cruz, Santa Rosa, San Miguel, San Nicolas, Santa Catalina, and San Clemente. It is not found on the two smallest islands, Santa Barbara and Anacapa (see "Castaways of California," by Christopher Nagano, Scott Miller and Charles Hogue, in *TERRA*, vol. 21, no. 4, Spring 1983, for a discussion of the animal life on the California Channel Islands).

As we focus in the state of California on mammal species that may be in need of special conservation efforts, more attention has been given to learning as much as we can of the biology and genetics of the island fox. Island species, because of their small population size, are easily affected by perturbations in their environment. The more information we have on their habitat, diet, behavior, disease resistance, and genetics, the better we can protect them from potential disasters.

We were gathering samples from all the island populations of foxes for an intensive examination of their genetic variability. We wanted to determine the amount of genetic variation within each island population and the genetic relationship of island populations to each other and to the mainland gray fox. It is not known when, or in what order, the islands were colonized by the foxes. We therefore wanted to propose a hypothetical route for colonization of the islands, based on these genetic data plus the fossil and archaeological record of the island fox.

The project is a collaborative effort between a number of museums and laboratories across the country. Some of the work was performed in the Biochemical Systematics Laboratory here at the Natural History Museum of Los Angeles County

(LACM); other work was done in Robert Wayne's mitochondrial DNA laboratory at UCLA and in Stephen O'Brien and Dennis Gilbert's DNA fingerprinting laboratory at the National Cancer Institute in Maryland. The morphological work was carried out at the Santa Barbara Museum of Natural History. Each worker analyzed a different type of data gathered from the foxes, and we compared our results to come up with a final hypothesis for the colonization route and an overall estimate of the amount of variability in the populations.

### COLLECTING THE DATA

The foxes were caught in wire cage traps with burlap wrapped around the back to shade the animals. Food was provided and the foxes usually built a nest from loose burlap. Each individual was weighed, measured, photographed, and combed for parasites found on their skin and fur; then blood samples were drawn and urine gathered, if we were fortunate, before the foxes were released unharmed. Fecal samples were gathered from the traps. Traps were run for two nights in a row, and half the animals caught the first night were recaptured the second night. In fact, on Santa Cruz Island, after we released one animal, it casually walked to the adjacent trap and set it off!

These animals are amazingly docile; they require no anesthetic for handling and wait patiently for the work to be completed before dashing back into the scrub. At least 22 animals were caught on each island to provide us with samples large enough to make the necessary statistical comparisons. We also obtained samples from mainland gray foxes for comparison.

In addition, Paul Collins measured hundreds of skulls of island and mainland foxes that are housed in museum collections in North America. Some of these collections include the LACM, the Santa Barbara Museum of Natural History, the San Diego Museum of Natural History, University of California—Berkeley's Museum of Vertebrate Zoology, and the Smithsonian Institution's National Museum of Natural History. These skulls provided additional information on morphological (or anatomical) variability that we couldn't obtain from live animals.

The urine samples were stored for future work on the reproductive physiology of the foxes: urine contains hormones that provide information on the reproductive status of individuals, such as whether they are capable of breeding at the particular time that the sample is collected or how mature the animal is. The fecal samples currently are being analyzed to determine the diet and internal parasites of the foxes.

The blood samples were spun in a centrifuge and separated into red blood cells, white blood cells, and serum. The serum was analyzed for antibodies to

OPPOSITE ►

An island fox in the wild.







Island foxes are only  $\frac{2}{3}$  the size of their nearest relatives on the mainland, the gray fox.

six common canine diseases. The white blood cells were used for DNA analyses at UCLA and at the National Cancer Institute, and the red blood cells were used in protein studies here at the Natural History Museum.

### COLONIZATION OF THE ISLANDS BY THE FOXES

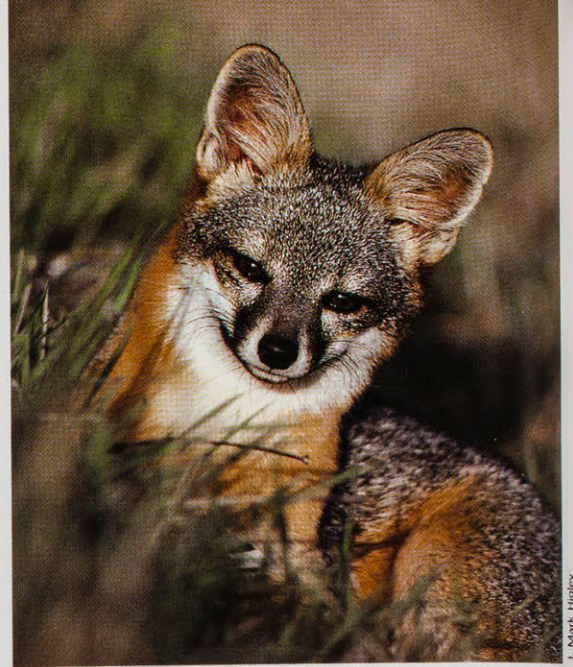
In order to propose a route of colonization for the foxes, we had to determine how the island populations were related to each other. These relationships are estimated from the amount of genetic similarity among the populations. Simplistically, if populations A and B share 25 of 30 characters analyzed and if population C shares 22 of these 30 characters with A and B, then we can suggest that A and B are more closely related to each other than either is to C. Using this logic, we can build "trees" of relationships among the populations, using the amount of genetic similarity as our building blocks.

We were able to construct four separate trees from analysis of our four types of data. First, we examined 20 proteins, looking for variations in the number of shared proteins among islands to use as our "building blocks." The mitochondrial DNA (a circular molecule found in the mitochondria, or "power-houses" of the cells) was subjected to a series of reactions with enzymes, breaking it into fragments. In this case, we compared the numbers of

Map showing the assumed colonization pattern by the island foxes. Mainland gray foxes first founded the northern island populations. Subsequently, San Miguel Island was the source for San Clemente and San Nicolas islands. Foxes on Santa Catalina Island are descendants of foxes from several islands.



Robert K. Wayne/Mary Beth MacKenzie



fragments shared between species and used these as our "building blocks" for our trees.

The nuclear DNA (strand-like DNA that makes up the chromosomes in the nucleus of the cells) also was cut into fragments with enzymes. The resulting fragments are very small and, in humans at least, produce a unique pattern in virtually every individual. These patterns are called "genetic fingerprints." The fingerprints have been found to be very useful in paternity analysis (because every individual inherits the unique pattern from his or her parents) and in forensic science. For the island foxes, we found that individuals do not all have unique fingerprints, and therefore we were able to find enough shared fragments to be able to build a tree and thus establish a pattern of relatedness. The morphological data were also subjected to a tree-building analysis, with the building blocks consisting of average overall similarity among the populations.

In each case, we compared the island foxes to the mainland foxes, and the island foxes were indeed very different from the mainland animals. The island foxes are certainly descended from the gray fox, but they have been isolated long enough and evolved enough genetic differences that they should continue to be considered a separate species. The data also suggest that all the island foxes were descended from a single small group or individual from the mainland, and that there was probably only one colonization event of the islands by a mainland gray fox.

The data also suggest that the populations on the northern islands (Santa Cruz, Santa Rosa, and San Miguel) are most closely related to each other, and that the populations on two of the southern islands (San Clemente and San Nicolas) are most closely related to the population on the northern island of San Miguel. The population on Santa Catalina appears to be an amalgamation and was probably founded by animals from several of the other islands.

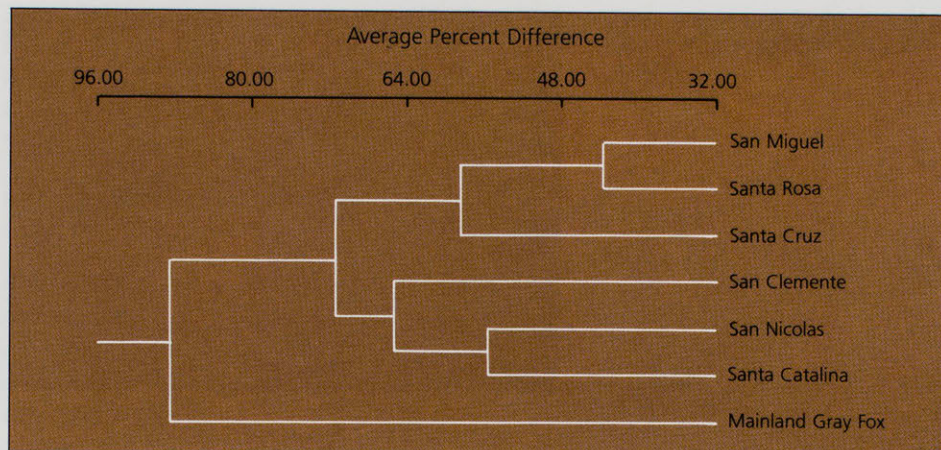
There are fossils of the island fox, as well as specimens of island foxes in the archaeological record. When we compare the evolutionary trees constructed from the genetic data to the fossil and archaeological record (which has been summarized



by Paul Collins of the Santa Barbara Museum of Natural History), we then can propose a colonization scenario. We believe that mainland foxes colonized the northern islands first. The oldest fossil is from deposits dated to approximately 16,000 years before present. The fact that the specimen is much smaller than the mainland gray fox indicates that the foxes arrived prior to 16,000 years ago and had time to evolve their small size. The sea level then was much lower than it is today, the three northern islands were connected to form a land mass that we now refer to as Santarosae Island, and Santarosae was only about 5½ kilometers (three and a half miles) from the California coast. It is highly probable that a pregnant gray fox, or a few gray foxes, swam or rafted from the mainland to Santarosae and founded the northern population (see *TERRA*, vol. 21, no. 4, Spring 1983 for descriptions of other species that reached the Channel Islands in this fashion).

As the sea level rose to current levels, the northern islands became separated from each other by water, and by approximately 9,500 years ago, the three islands we recognize today existed. Therefore, the one large fox population on Santarosae was split into three isolated populations and genetic divergence among the populations began.

Based on the protein and mitochondrial DNA data, populations on San Clemente and San Nicolas appear to be most similar to the foxes on San Miguel; therefore we believe that those populations are descended from San Miguel foxes. We know that Native Americans had active trade routes among the islands; we also know that they occasionally kept the docile island foxes as pets. Therefore, it is not



Robert K. Wayne

difficult to surmise that the Native Americans carried the foxes with them as they moved among the islands. It is probable that a random escape by a San Miguel fox or foxes founded the San Clemente population first. The San Clemente population was founded first because it has the older archaeological record (at least 3,400 years before present vs. 2,200 years before present for the oldest archaeological record of a fox from San Nicolas).

We believe that a San Clemente fox (or foxes) then was transported to San Nicolas. The San Nicolas population is genetically most similar to that from San Clemente (and San Miguel) and has virtually no genetic variability (see tree above). With each colonizing, or founding event, the newly colonized, or founded, population goes through what is referred to as a "bottleneck." The number of founding individuals is very small, and therefore possesses only a

Several cluster diagrams, or trees, were constructed from the different genetic data sets. For example, this tree was composed by comparing the average percent difference of genetic fingerprint fragments among populations. The islands with the smallest percentage of difference are closest together on the tree.



J. Mark Higley

Island foxes eat mice, small lizards, insects, grubs, roots, and berries. A far larger proportion of their diet is plant material than is normal for fox species.

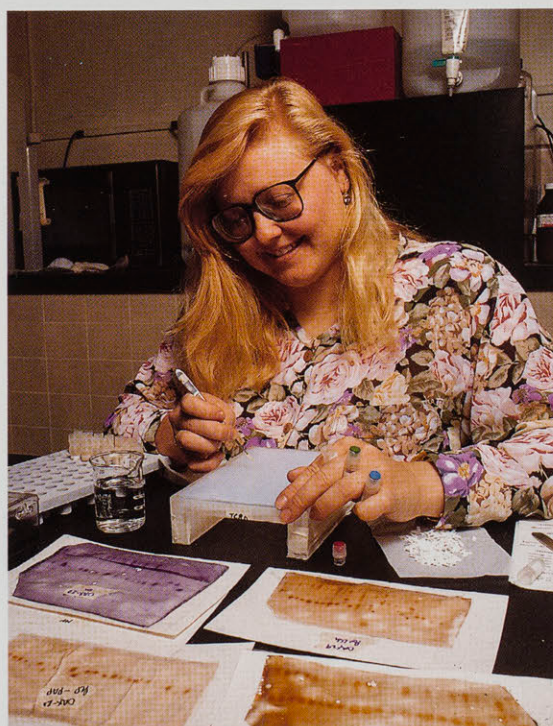


Measuring teeth for a study comparing Catalina Island foxes' teeth to overall tooth size.



Robert K. Wayne

The procedure for analyzing the proteins in the red blood cells at the museum involves putting a small sample of the blood on a paper wick and placing the wick in a starch gel, which is much like jello. Each gel has samples from 25 foxes, and an electrical current is then run through the gel. Proteins are molecules that vary in their size and electrical charge and as a result, they will move different distances through the gel. We then stain the gel to see the proteins and measure the distances that they have moved from their point of origin, which is, of course, the wick. How different the distances are gives us an indication of the differences between the proteins, and this is an indirect measure of the differences between the genes that are coding for the proteins. Student-in-residence Cheryl Watts is loading a starch gel with sample wicks; examples of stain results are in the foreground.



Dick Meier

A fox from Santa Rosa Island is photographed after blood samples have been drawn. Notice how docile the animal is — it has had no sedatives and patiently waits for the work to be finished.



Robert K. Wayne

small portion of the genetic variability that is in the entire ancestral or source population. If the San Nicolas population has gone through four founding events (mainland to Santarosac, San Miguel becoming separated from Santarosac, San Miguel to San Clemente, San Clemente to San Nicolas), then you would expect to see very little, if any genetic variability in it. This is, in fact, the case for the San Nicolas Island foxes.

The Santa Catalina Island population is more problematic. The evolutionary trees constructed from the mitochondrial DNA and the morphological data suggest that it is more closely related to the northern island populations, whereas the protein and fingerprinting data suggest that it is more closely related to the other southern island populations. Therefore, we believe that the population that exists on the island today is the result of several founding events, where foxes from both northern and southern islands were transported to Santa Catalina.

#### GENETIC VARIABILITY IN THE FOX POPULATIONS

It is important to determine how much genetic variability there is within each population of foxes. The amount of genetic variability gives us an indication of how healthy a population is. A population or species with low variability is less likely to be able to respond to environmental stress. For example, most species have much morphological size variability: big animals, little animals, medium-sized animals. If a species lives in an area where there is suddenly a dearth of food, the smaller individuals might be better able to survive because they need less to eat.

The analogy can be applied to protein and DNA variability, where one type of gene may confer a selective advantage on some individuals, enabling them to survive and reproduce under conditions where individuals lacking that genotype cannot. If a population or species lacks variability, the individuals that could survive a particular kind of population stress might not exist. In the case of the island foxes, we were able to estimate overall genetic variability from all four of the data sets described above.

Essentially, the fox populations on the largest islands, Santa Cruz, Santa Rosa, and Santa Catalina, have the greatest amount of genetic variability. The foxes on the smallest islands, San Miguel and San Nicolas, have the least genetic variability, whereas a middle-sized island, San Clemente, has an intermediate degree of variation. This is not unexpected: the smallest islands have the smallest populations. If there are few individuals in a population, they produce few offspring, and so the chances for genetic variability to appear (through mutation) and to be maintained are lower than you would expect in a larger population. All the island populations show



less variability than we see in the mainland California populations of the gray fox.

What is truly remarkable is the virtual lack of variability in foxes on San Nicolas Island. We detected little morphological variability, and no protein, mitochondrial DNA, or nuclear DNA (genetic fingerprinting) variability at all. In other words, every fox on San Nicolas Island is virtually identical to every other fox. For comparison, it has been estimated that the chance for two humans to possess the same genetic fingerprint is one in five billion unless they are identical twins. To our knowledge, no other wild mammal populations that have been examined have demonstrated such a lack of genetic variability, although a few species, such as the northern elephant seal, the naked mole rat, and the African cheetah come close.

Neither the elephant seal nor the cheetah appear to have any protein variability. We know that the northern elephant seal has undergone a relatively recent population bottleneck, when the species was hunted close to extinction in the late 1800s. With protection, the species has rapidly increased in numbers, but most of the genetic variability was lost and it will be many generations before it will be regained. Because of the lack of genetic variability in cheetahs, investigators have also proposed that the species has undergone a bottleneck as well, although there we have no information on previous population fluctuations.

The fact that island foxes have been able to persist on these islands for thousands of years without becoming extinct in spite of their small population size and lack of genetic variability provides the opportunity to examine some difficult questions in conservation biology. We know that individuals in small populations tend to inbreed, or mate with closely related individuals. This usually results in a high rate of deleterious traits being seen in inbred populations. For example, individuals in highly inbred zoo populations often have difficulty producing offspring that live to maturity. These offspring show more deleterious characteristics than are seen in normal, wild populations. Island foxes, on the other hand, do not appear to be affected by inbreeding. Future studies on these foxes may provide some insight in how the species has become tolerant of inbreeding.

The lack of genetic variability in island foxes, however, does raise concern about the potential for extirpation of any or all populations should any population, particularly that on San Nicolas, be exposed to environmental stress. An example of a potential disaster might be the introduction of canine distemper to the islands. In testing the serum of island foxes for antibodies to six common canine diseases, the only antibody not detected was that to distemper. We

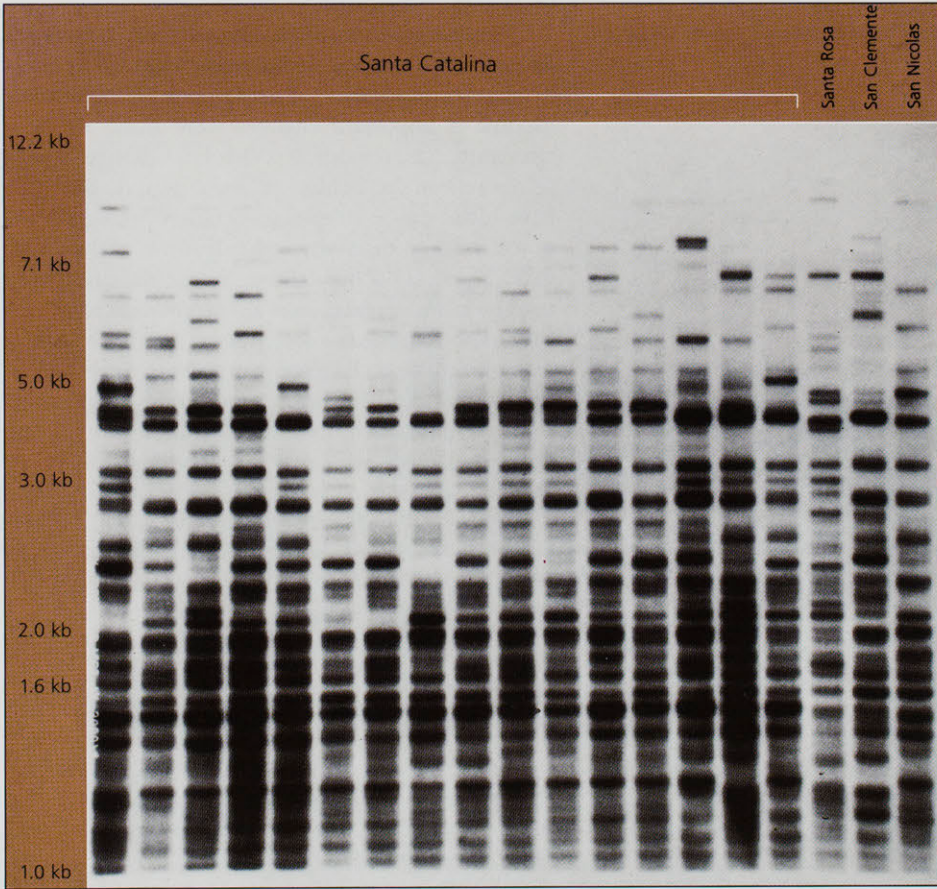
already know that canine distemper is particularly lethal to mainland gray foxes, and as they are probably the ancestors of the island fox, it is highly probable that the island species has the same susceptibility to the disease.

The State of California recognizes this potential and has officially listed the island fox as a "Threatened" species. This confers special protection on the species from any potential human perturbation. We have confidence that, with care and concern, these interesting, beautiful animals will continue to charm us for generations to come, as well as help us understand inbreeding tolerance for the benefit of other endangered animals.

*Dr. Sarah B. George is Associate Curator in the Mammalogy Section. She is interested in the evolution of small mammals and is working on establishing a Molecular and Biochemical Systematics Laboratory at the Natural History Museum.*

*Dr. Robert K. Wayne is a Research Associate in the Biology Department at UCLA and a Research Associate in the Mammalogy Section at the Natural History Museum. His research interests include conservation genetics of mammals and the evolution of canids (members of the dog family).*

Photograph demonstrating the genetic fingerprints of 17 island foxes. Each column is the fingerprint of a single individual. All individuals from San Nicolas have the same fingerprint. Some of the bands, or fragments of the San Nicolas individuals are shared with individuals from the other islands pictured here.



Robert K. Wayne



# It's A Question Of Interpretation:

THE DILEMMA OF RANCHO LOS CERRITOS

by Tom Sitton

CREATING A PROGRAM FOR INTERPRETING a historic site sometimes can be relatively easy. Consider a Victorian house built in the late 19th century for a community founder. Representing architecture typical of the period, having been a political and social center for the community in its infancy, and remaining as the most apparent legacy of a founding family, the structure has experienced only minor changes over the years: the installation of indoor plumbing, perhaps a few lowered ceilings, new and improved appliances in a slightly remodeled kitchen, an associated carriage house converted into a modern garage. With only slight modifications the house is "restored" to its late-19th-century grandeur with later changes so minuscule that they cannot be noticed. The house is decorated in original or period furnishings supplemented by photographs and other objects relating it to the development of the community. Tours, designed to beam visitors back to the heyday of the house's glory, are scheduled, and special events on holidays and other occasions are slated to celebrate noteworthy dates for the house's occupants and neighbors. For the creator of this interpretive plan, the structure provides endless opportunities and few out-of-the-ordinary problems in reconciling "history" with the physical remains of one of its participants.

But sometimes interpreting history is not such an easy task. In recent decades new ideas led to questioning the restoration of sites to one period of their lifetime if important changes were made to them afterward. The reasoning is that later changes themselves reflect the culture of their period, and may have historical or cultural associations as significant as (or more so than) the earlier features of the structure. Thus, say some experts, rather than restoring back to just one point, later alterations and additions should be examined to determine if they have historical significance equal to or greater than mere seniority. These modifications, if deemed important, should be retained, and the site presented to the public as an evolving entity reflecting successive eras, not as an artifact frozen in time. This idea is codified, to some extent, in the federal *Secretary of the Interior's Standards for Historic Preservation Projects* of a decade ago, but it has done little to quash controversy.

A notable example is the case of Montpelier, the homestead of former President James Madison in Orange County, Virginia. Madison inherited the house from his parents and enlarged it both before and after his 1809-1817 administration. The house was later acquired by members of the Du Pont family, who by the early 20th century had made extensive additions to it. Montpelier now belongs to the National Trust for Historic Preservation, which in recent years has grappled with the problem of whether

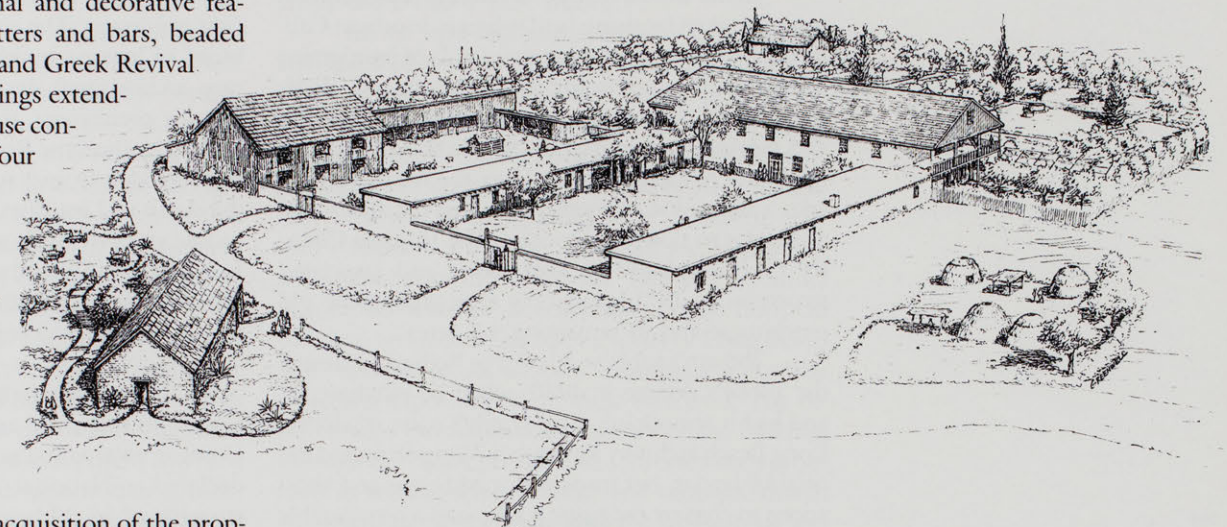
to restore the structure back to its appearance at the time Madison lived there, or to preserve it with the later additions and include the Du Pont residency in the interpretive plan of the site.

As public interest in historic preservation grows, this dilemma surfaces more and more frequently. One California example is the Casa de la Guerra, one of Santa Barbara's oldest structures. An adobe house built by José Antonio de la Guerra y Noriega between 1818 and 1827, it now belongs to the Santa Barbara Trust for Historic Preservation. The house has experienced a number of changes since its construction and now awaits a decision on its future appearance.

An example even closer to home is the Rancho Los Cerritos Adobe in Long Beach. Located in the center of a private country club, the adobe originally was built in 1844 as the ranchhouse of John Temple, a New England merchant who had purchased part of an original Spanish land grant in Southern California the year before. Temple became a naturalized Mexican citizen and established a large-scale cattle ranching operation on his holding of some 27,000 acres surrounding the house. The adobe was only sporadically used by Temple; his primary residence was a townhouse on Main Street near the plaza in Los Angeles, where he built a merchandise store and the first courthouse in the city. By 1852, he was the wealthiest individual in Los Angeles County, influential in economic, political, and social affairs.

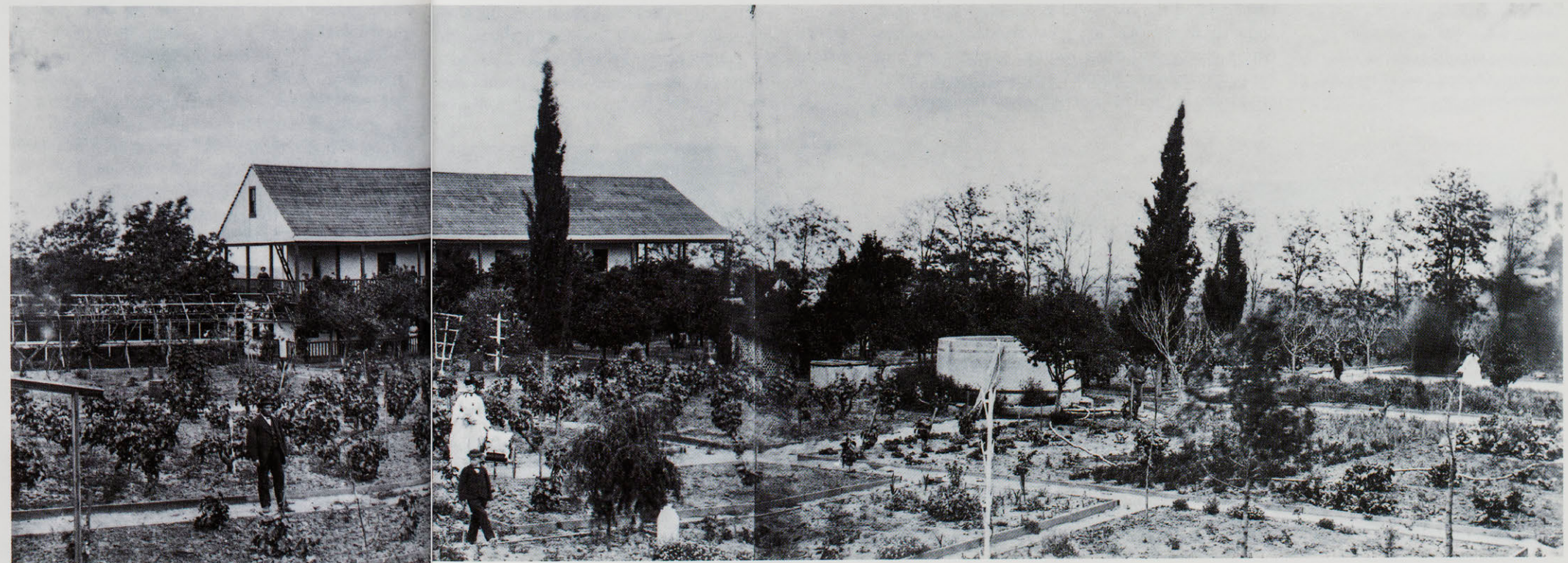
When he spent time at the ranch, Temple lived in the spacious ranchhouse, which he probably designed himself. The Monterey-style two-story adobe, with balconies on three sides and a flat roof covered with *brea*, was a rarity at that time in southern California. The house's functional and decorative features included window shutters and bars, beaded tongue-and-groove ceilings, and Greek Revival detailing. Long, one-story wings extending from both sides of the house connected to a high wall, the four elements enclosing a central courtyard. The wings accommodated workrooms, storerooms, and quarters for the ranch foreman. In the rear of the residence was Temple's formal garden, containing a range of flora from rose beds to fruit orchards, and renowned as one of the finest in Southern California.

Two decades after his acquisition of the property, Temple's fortunes plummeted as droughts decimated the local cattle industry. In 1866, he sold Rancho Los Cerritos to the sheep ranching firm of Flint, Bixby & Company. Jotham Bixby, who became part-owner within three years, managed the ranch, which produced wool supplied from its flock of some 30,000 sheep. Bixby and his family lived in the



ABOVE  
1987 drawing by Gil Sanchez shows proposed restoration of Rancho Los Cerritos as it might have looked in the 1870s. The view is looking northeast. It includes several buildings that do not exist at this time. Courtesy Rancho Los Cerritos.

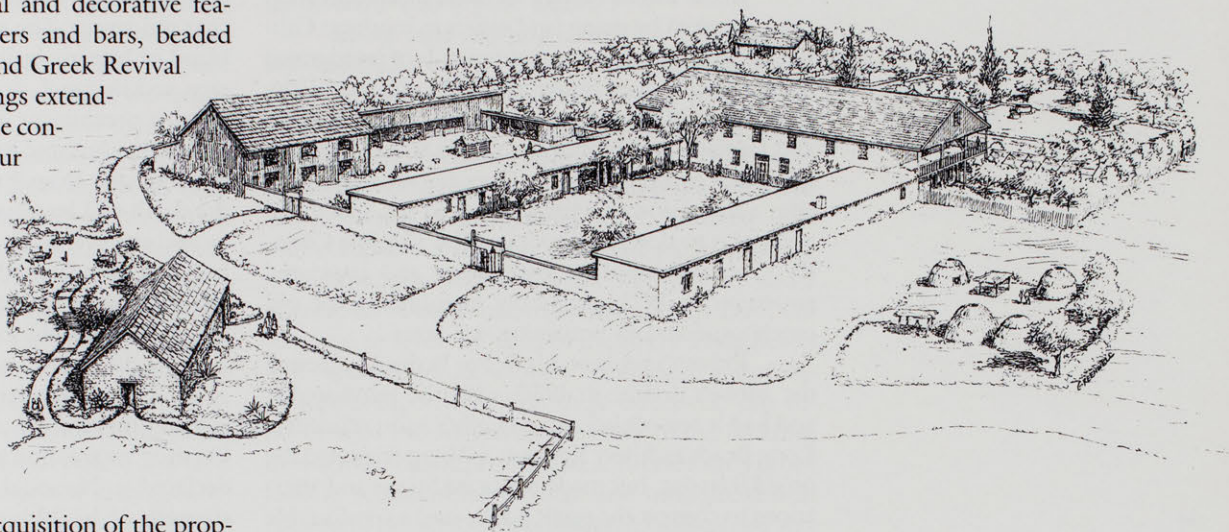
BELOW  
The ranchhouse from the east in the 1870s. This was the original back of the house (it is now the facade). It sported a three-sided veranda and faced an elaborate garden. Courtesy Rancho Los Cerritos.





When he spent time at the ranch, Temple lived in the spacious ranchhouse, which he probably designed himself. The Monterey-style two-story adobe, with balconies on three sides and a flat roof covered with *brea*, was a rarity at that time in southern California. The house's functional and decorative features included window shutters and bars, beaded tongue-and-groove ceilings, and Greek Revival detailing. Long, one-story wings extending from both sides of the house connected to a high wall, the four elements enclosing a central courtyard. The wings accommodated workrooms, storerooms, and quarters for the ranch foreman. In the rear of the residence was Temple's formal garden, containing a range of flora from rose beds to fruit orchards, and renowned as one of the finest in Southern California.

Two decades after his acquisition of the property, Temple's fortunes plummeted as droughts decimated the local cattle industry. In 1866, he sold Rancho Los Cerritos to the sheep ranching firm of Flint, Bixby & Company. Jotham Bixby, who became part-owner within three years, managed the ranch, which produced wool supplied from its flock of some 30,000 sheep. Bixby and his family lived in the



ABOVE

1987 drawing by Gil Sanchez shows proposed restoration of Rancho Los Cerritos as it might have looked in the 1870s. The view is looking northeast. It includes several buildings that do not exist at this time. Courtesy Rancho Los Cerritos.

BELOW

The ranchhouse from the east in the 1870s. This was the original back of the house (it is now the facade). It sported a three-sided veranda and faced an elaborate garden. Courtesy Rancho Los Cerritos.





ranchhouse for some fifteen years, making minor changes to the building along with the addition of a hipped roof covered by wooden shingles. As in John Temple's era, the house continued to be a social center in the Long Beach area.

In the 1880s, Bixby's lucrative sheep operation was overtaken by rising land values in southern California. In these boom years thousands of immigrants arrived in search of house lots and farmland. Bixby leased and sold parcels of the ranch to city-builders and farmers, and moved his family to Los Angeles (and later to Long Beach). Over the next four decades a succession of renters occupied the adobe and allowed it to slowly deteriorate. The Virginia Country Club developed its golf course and associated structures in 1921, practically surrounding the old ranchhouse and its remaining 4.7 acres.

Jotham's nephew, Llewellyn Bixby, II, arrested the adobe's decline in 1930, when he purchased it and had it remodeled as his family's main residence. Long Beach architect Kenneth S. Wing respected the original layout, but made major additions and alterations to convert the rustic adobe into a comfortable residence. Interior walls were shifted, the ceiling of the first-floor living room was removed, door openings became windows and vice-versa, and new doors and hardware were added. More significantly, the main entrance was moved from the courtyard interior to what had been the rear wall adjoining the garden. An enclosed sun porch acting as a main hallway was added to the courtyard side, and the upper and lower verandas on the north side were enclosed. Red tiles replaced the old wooden shingles on the roof, and walls were moved in the two wings to accommodate a garage and other rooms. At the same time landscape architect Ralph Cornell designed a modern garden located in front of the new main entrance.

Surrounded by a new brick wall, this two-acre garden retained some of the original trees in John Temple's garden of the 1850s.

The 1930 renovation spared the Los Cerritos adobe further deterioration and possible demise, and reestablished it as one of Long Beach's most significant residences. The structure became unique for its blend of historic building materials and contemporary architectural design by Wing, one of Long Beach's preeminent architects. And it was accomplished by the same Bixby family that had shaped the city's growth from a rural to an urban center. After the death of Llewellyn Bixby, II in 1942, his family moved and eventually sold the property to the city of Long Beach. Since then it has been operated as a historic house museum, complemented by its growing library of Californiana.

But which period of its history should it represent? Initially, the answer appeared to favor Los Cerritos' incarnation as a sheep ranch: in 1970, it was declared a National Historic Landmark on the strength of its 19th-century significance. Eighteen years later the adobe was designated California Registered Historical Landmark No. 978.

Since the City of Long Beach opened Rancho Los Cerritos to the public in 1955, the museum staff has geared its interpretation toward the period from the 1860s to 1880s. With a dearth of reliable information concerning John Temple's occupation from 1844 to 1866, and little appreciation of the adobe's 1930 architectural reconstruction (only a quarter of a century old by this time), staff members decided from the beginning to recreate the ranch at the zenith of its sheep ranching phase. *Adobe Days*, a vivid recollection of everyday life at Los Cerritos during the 1870s written by Sarah Bixby Smith, only child of

LEFT  
The southeast corner of the courtyard interior about 1872. Note the old wood shingle roof on the house and flat roof on the extending south wing. Courtesy Rancho Los Cerritos.

RIGHT  
The original back of the house was virtually a ruin in the early 1900s. Much of the veranda railing is missing, as is the famous Temple garden. The small outbuilding to the right is a "six-seater" outhouse. Courtesy Seaver Center for Western History Research.





Llewellyn, served as a guide for interpreters to present the story of a middle-class American family's adaptation to life in southern California in the early years of statehood.

With the decision now made to fix the interpretive era in the latter 19th century, administrators began filling the empty adobe with furnishings acquired from the Bixby family and other sources. Tours were designed to explain the role of the family and the significance of the ranch, to place them in the larger context of southern California's development in the late 19th century, and to illustrate the joys and drudgery of everyday life on a sheep ranch at that time. Special programs were created to complement the chosen interpretation, but nagging the interpretive program was the frequent suggestion that the adobe should be altered to its 1860s-1880s appearance to give visitors a more accurate idea of what the ranch looked like then. It was misleading, historians said, to suggest that the brick patios and sidewalks, fish pond, palm trees, verandas, sun porch, and tiled roof, among more obvious alterations such as bathrooms and electricity, were amenities of a working sheep ranch. In the 1870s the floors were beaten earth, not wood as they later became. Some windows had no panes, the adobe walls had to be repaired yearly, and the rooms in the wings were used for the work of the ranch — smithing, repairing, storage — not as the comfortable guest rooms they became in 1930. The redesign of 1930, reflecting the changed function of the house from a labor headquarters to a luxurious home, had made it exceedingly difficult to give an accurate depiction of the 1870s, even with substantial diorama-like reconstructions. And yet the warmth and charm of the 1930 redesign was undeniable, perhaps even more of an attraction than the original ranch would have been and certainly

architecturally significant. But even if the decision had been made to restore Los Cerritos back to 1870, it would mean massive restoration, which depended on massive money — almost always in short supply for historic house museums. Consequently, no substantive alterations were made.

In the mid-1980s, the Rancho Los Cerritos staff initiated a survey of collections and programs as a first step toward composing a master plan for the site. The obvious incongruity of an 1870s sheep ranching interpretation enclosed in a 1930-vintage structure was again raised, and local professionals in museums and other agencies were consulted. The staff composed a mission statement recommending an interpretation era of the late 19th century and a restoration of the adobe to that period. In 1987, Gil Sanchez, an architect hired by the city of Long Beach who specialized in adobes, completed a historic structures report based on these directives. The report traced the architectural history of the building through the major periods and addressed such problems as seismic reinforcement and moisture-driven erosion of the adobe walls from the landscaping and remodeling of 1930. A detailed plan for the property was presented in which the ranchhouse would be transformed in several phases to its appearance in the 1870s. Finally, many people thought, the question had been laid to rest and the perfect blueprint for the future of Rancho Los Cerritos had been found.

But, alas, no. When the Sanchez report was submitted to the Long Beach Cultural Heritage Commission, which had to approve such alterations to the city's historic landmarks, a philosophical dispute ignited. Commission members and others questioned the wisdom of removing the substantial 1930s architectural material and ignoring the building's experience in the twentieth century. Their arguments

LEFT  
Deteriorating adobe in the courtyard interior in the early 1900s. Courtesy Rancho Los Cerritos.

RIGHT  
The exterior of the courtyard with adobe wall almost gone in the early 1900s. Courtesy Rancho Los Cerritos.







The southeast corner of the courtyard interior, 1991. Clearly evident are some of the additions from the 1930 alteration: red tile roof, glassed sun porch, pool, and plantings.

were bolstered by comments on the Sanchez report by a National Park Service preservation architect, who argued that the 1930s modifications, including an innovative bond beam system to reinforce the walls, were now historically significant in their own right. The proposed restoration, he asserted, was actually a "reconstruction," considering the amount of historic material to be removed. He advised the Los Cerritos staff to eschew the Sanchez plan and "incorporate the 1930s architecture of the building into its presentation to the public."

The staff was at an impasse. The three-decade tradition of interpreting the site as a 19th-century sheep ranch and the vision for a "restoration" of the adobe had been sharply challenged. Even if the staff could compose such a new interpretive plan, it would be major work to overhaul the present tours, exhibits, and other programs based on the sheep ranch. Volunteer support groups comfortable with the established interpretation expressed concern about the proposed changes, as did local school teachers who incorporated tours of Los Cerritos in California history courses.



Present-day roofline of the Los Cerritos Ranchhouse, showing the 1930 roof, now itself in need of repair.

A simple solution was not readily apparent, so the Los Cerritos staff appealed for assistance. In response, Long Beach Mayor Ernie Kell appointed a task force of 17 representatives active in local history, cultural affairs, business, architecture, and community interest groups. Chaired by Vice Mayor Jeffrey A. Kellogg, the task force was charged with exploring the architectural, interpretive, and financial issues concerning Rancho Los Cerritos and recommending solutions. Among the many questions to be answered were: what was so unique about this rancho? How could that special quality be translated into an effective interpretation that would attract community support, visitors, and funding opportunities? What sort of innovative educational experience could be forged out of the building's present appearance, saving the 1930s modifications?

For eight months the Mayor's Advisory Task Force for Rancho Los Cerritos wrestled with these and other concerns. Proposals, old and new, were made in abundance. One idea called for the adobe to be kept virtually intact and used as a city history museum, perhaps as a joint venture with the Long Beach Historical Society. Another suggestion, based on retention of the 1930s changes, involved a presentation of the ranch over the span of a century (1840s-1940s), treating all major eras in various exhibits throughout the house, and relating the ranch to the resident families and the concurrent development of Long Beach. A variation on this plan included presentation of the 1930s stylistic features as that era's romanticizing of the Hispanic past, a manifestation of the search for the California dream through architecture. Also proposed was the addition of a special collections archive of maps and other material related to land development in southern California, a subject especially suited to a rancho subdivided into so many parts.

All of these suggestions had some degree of merit, yet they faced formidable obstacles beyond the expensive price tag for whatever structural work was to be done. Because of its location far from downtown Long Beach, Rancho Los Cerritos had to project a unique and magnetic message to attract tourists and other short-term guests from the city's distant center. An interpretive era of 1840-1940 would place Rancho Los Cerritos in competition with its sister site, Rancho Los Alamitos, another Bixby family ranch located nearby which emphasized its early 20th-century operation. Moreover, Rancho Los Alamitos had abundant financial resources and a fully-developed master plan. Some visitors and school groups might choose to tour one of the two sites, but probably not both. The rancho's pre-Bixby and post-sheep eras would have to be illustrated with three-dimensional objects; could they be readily ac-

John DeLeon

John DeLeon





John DeLeon

quired? And how could exhibits effectively interpret several eras of rancho history at the same time?

Without a sophisticated plan of interpretation, it proved difficult for the Advisory Task Force to visualize a program for the ranchhouse in its present form. And the site was too important to be treated with anything other than careful attention. So, in 1990, a National Endowment for the Humanities study grant was sought, to pay eight interpretive specialists to analyze the site and formulate short- and long-range interpretive goals. Their findings would be incorporated into the task force's final report to the Mayor and City Council of Long Beach.

In approving the grant in May, the N.E.H. stated that the issues facing Rancho Los Cerritos are not unique. Rancho Los Cerritos will now become the focus of intense study by consultants and specialists who will produce recommendations early next year. Whatever those recommendations are, Los Cerritos will find itself, in its next incarnation, serving as a model of how to — or how not to — interpret a historic landmark in a similar predicament.

*Tom Sitton, an Associate Curator in the museum's General Americana section, is responsible for surveying historic sites in Los Angeles County. He is a member of the Mayor's Task Force for Rancho Los Cerritos in Long Beach.*

The present facade of the Los Cerritos Ranchhouse, 1991. This was the original back of the house.



# Megamania

## THE CONTINUING SAGA OF MEGAMOUTH SHARKS

by Robert J. Lavenberg



**J**UST PAST MIDNIGHT ON SUNDAY, OCTOBER 21, 1990, Otto Elliot began the arduous task of recovering his drift swordfish net about six miles due west of Dana Point. He noted that something large was tangled in the webbing. The net had been set near the surface, to a depth of about 31 meters (100 feet), on the previous night. About two-thirds of the way down the net, approximately 23 meters (75 feet) below the surface, a large animal was encountered. Otto, who has been a commercial fisherman for 16 years, had never seen such an animal. It had sharklike features, yet it looked like a baby killer whale. He immediately realized that someone should see it. Since the shark was not wrapped tightly or twisted in the net, it apparently had not struggled while entangled. Covered by a single layer of webbing, it was relatively easy to retrieve from the net without hurting more than its pride. A slip line around its enormous tail secured it while it was being recovered from the net.

As the shark was being unraveled, Otto and his son, Rob, noted that it was a large male, appeared to be quite healthy, and was swimming with sufficient force to tug on the attachment line. They decided to bring the shark into Dana Point alive. As they walked it alongside their boat, the *Moonshiner*, to secure it for the trip home, it smacked the boat powerfully several times with its tail. In order not to hurt the shark further, Otto returned to port at idling speed, a trip that took almost 8 hours. They arrived at Dana Point at 9:30 in the morning, and the excitement of the catch began to spread.

At 10:25 a.m., Susan Gendron, an aquarist at Sea World, called to tell me that a living megamouth shark had reportedly been captured and was at the Dana Point wharf. Could I verify the information?

I had no way of knowing whether or not a megamouth shark had really been found, and I did not want to influence Otto's description of the shark; I wanted him to tell me in his own words what he had caught. For several minutes Otto described the huge shark over the telephone, and finally noted that it seemed unique to him because it had a big round head and looked like a small whale. That was enough! I drove for two hours to reach Dana Point.

It was shortly after 12:30 p.m. when I arrived at Otto's vessel. It was a bright, warm, sunny day and hundreds of people were gathered along the wharf. Rob pointed to starboard, and then picked up a heavy line and began to pull vigorously. The shark had been resting on the bottom, about 4.6 meters (15 feet) from the surface, in very murky green water. At first an enormous tail broke the surface and splashed about with some force, and then the entire shark rose to swim alongside the vessel. Even though the water was murky green, the tell-tale bulbous head

was clearly evident — Megamouth VI had indeed been captured.

Quickly I called Sea World with the news: a live, adult male megamouth shark, only the sixth one known, about 5 meters (16 feet) long and 700 kilograms (1,540 pounds), was swimming actively at Dana Point. Since Sea World had made the initial contact with me, I was hoping that they could provide the facilities to study this shark. After a long wait, Sea World returned my call with sad news. They did not have the facilities to care for the shark. More calls were made, and one after another, the leading sea life parks declined to accept the sixth living megamouth shark.

I recognized that we had a chance to document observations about this shark that would make significant contributions to the knowledge of the species. Some questions could not be answered because they would mean having to kill the shark, like inquiries about internal anatomy, or what they eat. What could be answered, perhaps, were questions about the possibly luminescent mouth tissue that had been observed in earlier megamouths. The shark's color could be noted and recorded, its movements, particularly the ways in which the enormous head and jaws are used, could be observed, and its behavior could be documented. I had a suspicion that megamouths were vertical migrators — animals that ascend to the surface at night and return to the depths before dawn — and perhaps this could be confirmed.

At the dock, I learned that an employee of the harbor master's office, Wendy Costello, and her colleague Jim Lund had observed a large, strange-looking animal about 3.2 kilometers (2 miles) off Dana Point on the morning of October 10, 11 days earlier. At 10:30 a.m., they had spotted a very large animal rising to the surface. They thought it was some kind of whale, but could see no evidence of the tell-tale spouting that would confirm it. The animal slowly rose in the water, and then swam along the surface for a short period before descending. It moved like a large swimming fish and not in the arched-back posture of a marine mammal. A single dorsal fin was seen, and another white fin — probably pectoral — was observed. Three times the brown-grey back of the animal came to the surface, and then slowly and quietly disappeared. Its tail never broke the surface. When they reached port, Jim and Wendy described their sighting to their colleagues. All were mystified. Then on Sunday morning, October 21, they heard about Otto's capture. As the shark was brought to the surface, Wendy exclaimed, "That's it!"

But was this the same shark? Are there other megamouth sharks, perhaps females, patrolling off Dana Point?



Megamouth VI resting near the bottom at a depth of 45 feet off Dana Point in southern California. The white line on the upper jaw is a fresh scar.



Mark Dell'Aquila



On November 15, 1976, off the Hawaiian island of Oahu, the United States Navy recovered a large shark that had the appearance of a "killer-whale." Everyone decided immediately that this strange animal qualified as "sea monster," and it was hoisted aboard and returned to port. The next day the newspapers heralded the discovery of the new shark, dubbing it "megamouth" in allusion to its unusually large mouth. Upon seeing the shark, Leighton R. Taylor, an ichthyologist who was director of the Honolulu Aquarium at the time, recognized that it was unique. Almost seven years later it was formally named by Leighton Taylor and others *Megachasma pelagios* (see references), a new species that represented the sole member of the unique new family of lamnoid shark called the Megachasmidae. The mystery had begun.

The capture of the first megamouth was exceptional in every way, beginning with its bizarre entanglement, not in a net, but in a parachute drogue, an apparatus used to slow down spacecraft and satellites re-entering the earth's atmosphere. The parachute had been deployed at 165 meters (536 feet) at a place where the ocean depth was greater than 4,000 meters (13,000 feet). The naval vessel, which was recovering torpedoes, stumbled upon it. Although it was unknown at that time, 165 meters turns out to be the normal depth at which megamouth sharks swim during the day. Of great mystery, though, was how a

giant, pelagic, filter-feeding shark could remain undetected until late in the twentieth century, especially considering the extent to which the world's oceans have been fished. It seems incredible that we had no clear idea that such an animal as megamouth existed until 1976.

Or did we?

Among the unidentified fossil shark remains in the Natural History Museum of Los Angeles County and the University of California Museum of Paleontology at Berkeley are small, well-worn teeth from sites in central Oregon, northern California, and the San Joaquin Valley. These teeth date from earliest Miocene or late Oligocene times, about 26 million years ago. Because they are small and lack the distinct cutting edge that characterizes most shark teeth, these teeth have languished in the collections among the unidentified sharks. Remarkably, the teeth from Megamouth I resembled the fossils in our collection, indicating that they represented a species of fossil megamouth shark (see box, page 35). Megamouth sharks have probably frequented the waters off western north America for at least 26 million years, and yet their fossil remains defied scientific discovery and living individuals escaped detection for hundreds of years.

*Megachasma pelagios* joins that select group of the world's giant sharks, those longer than 4 meters (13 feet), including the sixgill shark (*Hexanchus*), Greenland and sleeper sharks (*Somniosus*), basking shark (*Cetorhinus*), white shark (*Carcharodon*), tiger shark (*Galeocerdo*), great hammerhead (*Sphyrna*), common and bigeye thresher (*Alopias*), and the granddaddy of large sharks, the whale shark (*Rhincodon*). These sharks were discovered and formally introduced into the scientific literature in the late 17th and early 18th centuries, principally because, as near-surface dwellers, they are easily seen and caught. Not so megamouth sharks.

By their very nature gigantic sharks, like the white and tiger sharks, conjure up images of menace, for they have been sensationalized as huge, brutal animals, voracious man-eaters, and death stalkers. But not all sharks should be so depicted. Megamouth and the sixgill shark, Greenland and sleeper sharks, the basking shark, and the whale shark are docile, gentle giants of the sea. As far as we know, they are harmless to man. Megamouth sharks are plankton-ivores. As they swim, they gulp in huge volumes of water, which is filtered through sieve-like gill rakers to remove and eat small shrimp-like animals. The first megamouth shark was obviously a filter-feeder as it was characterized as having gill rakers, a bathtub-shaped lower jaw made for sucking in large volumes of water, an enormous short-snouted head unsuited for predation, and numerous small vestigial teeth — precursors of the gill rakers.

## KNOWN MEGAMOUTH SHARK CAPTURES

### Megamouth I

**FOUND** November 15, 1976  
Central Pacific, 42 km northeast of Kahuku Point, Oahu, Hawaii  
**SIZE** 4460 mm  
**GENDER** Male  
**STATUS** Bernice P. Bishop Museum, Honolulu, preserved

### Megamouth IV

**FOUND** January 23, 1989  
Western North Pacific, 0.5 km south of Kogawa, Ishizu, Yaizu-shi, Shizuoka, Japan  
**SIZE** ca. 4000 mm  
**GENDER** Male  
**STATUS** Dead, lost

### Megamouth II

**FOUND** November 29, 1984  
Eastern North Pacific, 4.5 km off west end, Catalina Island, California  
**SIZE** 4490 mm  
**GENDER** Male  
**STATUS** Natural History Museum of Los Angeles County, preserved

### Megamouth V

**FOUND** June 12, 1989  
Western North Pacific, 0.5 km south of Kogawa, Ishizu, Yaizu-shi, Shizuoka, Japan  
**SIZE** 4900 mm  
**GENDER** Unknown  
**STATUS** Released alive

### Megamouth III

**FOUND** August 18, 1988  
Eastern Indian Ocean, off Perth, Western Australia  
**SIZE** 5150 mm  
**GENDER** Male  
**STATUS** Western Australian Museum, Perth, preserved

### Megamouth VI

**FOUND** October 21, 1990  
Eastern North Pacific, 7.0 km off Dana Point, California  
**SIZE** 4949 mm  
**GENDER** Male  
**STATUS** Released alive





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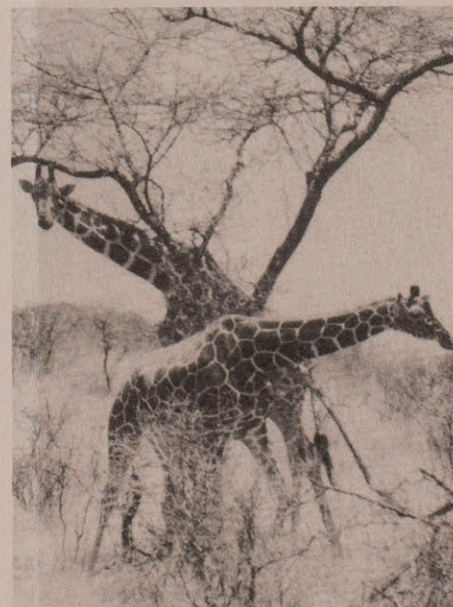
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The discovery of Megamouth I torpedoed our knowledge of animals in the deep scattering layer — a level between 160 and 300 meters (520-975 feet) throughout the ocean. Each night, the animals living in it migrate as a layer to the surface. Before dawn, they swim back to the deep. The purpose of these daily migrations remains a mystery, but the assumption is that they come to the surface to feed, to mate, or to escape predation.

It was assumed that Megamouth I lived in such depths based on its coloration, soft, flabby musculature, weak fins, weakly calcified skeleton, and asymmetrical tail that lacked keels. Animals that live under the enormous pressure of tons of water usually have tissues that can be compressed, skeletons that are unreinforced, and other simple, unmodified morphological features. But no animals as large as megamouth have been known to live in the scattering layer; most of its full-time inhabitants are typically no more than five to 7.5 centimeters (two or three inches) long. What was this huge shark doing down there? Presumably, it was feeding, but no large feeders had been known to live and eat within the deep scattering layer before the discovery of Megamouth I.

Vertical migrators include the microzooplankton (small drifting unicellular organisms), zooplankton (larger multicellular planktonic organisms), and nekton (larger free-swimming organisms, like fishes). Vertical migration results in a nightly near-surface concentration of planktonic prey, which could provide a rich food supply for animals like megamouth sharks. Except for nekton, most vertical migrators are tiny, and clearly megamouth sharks are the giants among them.

Conventional wisdom held that future catches of megamouth sharks would be rare indeed, since they lived at such depths. For eight years and 14 days, that seemed to be the case; no other megamouth shark was captured. Then came a spurt of phenomenal activity. On the night of November 29, 1984, a second megamouth was captured off Santa Catalina Island in southern California. The third swam ashore off Perth, in western Australia, in 1988. The fourth drifted ashore dead in Suruga Bay, Japan in January, 1989 and was lost in the outgoing tide. The fifth was captured alive in a fishing net 0.5 (164 feet) kilometers off shore in Suruga Bay, Japan in June, 1989 and released alive. The sixth was captured off Dana Point in October, 1990 and was released alive. Such is conventional wisdom: five large megamouth sharks were found in a period just a few days shy of six years.

The capture of the sixth megamouth shark provided a unique opportunity to photograph, observe, and study a living individual. Megamouth VI was no small fish, being second in size to the Western



Dick Meier

Australian shark. This mature, sexually-active male measured 16'1" long underwater and 8' in girth just behind the pectoral fins. Its weight was estimated at about 700 kilograms (1,540 lbs.), based on the data from Megamouths I and III.

During the time of its captivity, this huge animal was completely passive, never once exhibiting aggressive behavior. From time to time it swam with considerable force in what was interpreted as an attempt to escape, but quickly resorted to a relaxed "floating" mode in which it would roll about and frequently rest motionless in a belly-up posture.

Megamouth VI was a handsome, stately creature, and its color was completely unexpected. Its back and sides were golden bronze, and the belly white, with a pronounced counter-shaded pattern. This is a color pattern more typical of sharks of nearshore or shallow oceanic habitats, not of fish of the dark, cold, deep oceanic waters. Further, the tips of its paired fins were clearly white, and the leading edge of the pectoral fins had a sharply defined black edge. It is the posture and color of the pectoral fins that give megamouth sharks the appearance of a "baby killer whale." Another curiosity of color is the profusion of quarter-sized black spots on the lower jaw.

While swimming about this gentle giant to visually inspect it, we found only two obvious wounds, one on the throat and one on the lower jaw. The throat wound resulted from a gaff; the other is assumed to be the result of a female megamouth grasping the lower jaw during mating, an activity which is often bloody and fractious among sharks. Usually males grab one of the pectoral fins of a female to twist her about to insert a clasper (a male

The mouth of Megamouth II, showing the large muscular tongue, which assists in forcing prey into the throat as food is gulped.



## Fossil Teeth Fill in Part of the Story

As early as 1961, associates of the Natural History Museum of Los Angeles County were collecting fossil shark teeth in an early Miocene sand deposit, the Jewett Sand, in Kern County, California. Among the many kinds of teeth in this deposit were peculiar ones of unknown affinity. Little research was done on the Jewett Sand fossils, and these teeth remained enigmatic until 1976, when the first Megamouth shark (family Megachasmidae) was collected near Hawaii. This shark, entirely new to science, had teeth very much like those problematical teeth from Kern County.

The fossil history of most sharks is known mainly from teeth. There are two reasons for this. First, teeth and scales are about the only hard tissues in a shark skeleton. The numerous teeth in a shark's mouth are frequently lost and replaced during the life of the shark, and are easily identified as isolated fossils. Second, most of a shark skeleton is composed of cartilage and does not usually fossilize. Even though some cartilage may be preserved as fossils, the skeletons are usually broken up, and the identity of isolated bits of fossil cartilage is difficult or impossible to establish.

Megamouth is thought to belong to the major group of predatory sharks known as lamnoids. A generalized lamnoid shark tooth has a large principal cusp with at least one pair of accessory cusps and a root with two prominent lobes and a modest projection on the side next to the tongue (the lingual side). In the primitive state, vascularization of the lamnoid tooth is provided through a foramen, or small perforation, situated in a faint groove on the lingual side of the root. Wear on a lamnoid tooth is generally seen at the tip of a major cusp.

The Jewett Sand fossil teeth (10 to 11 mm. long), are a little smaller than those of Megamouth (13 to 14 mm.). Both have a very pointed, shiny, central cusp on a more or less bilobed root. This cusp is curved posteriorly. The crown of each is fairly flat on the lip (labial) side, and very convex on the lingual side. Both have a foramen. The lingual side of the root has a very prominent bulge in both. The substance composing the inside of both teeth is called osteodentine. The teeth of both show some peculiar wear facets nearly parallel to the plane of the labial surface. In addition to these facets are sets of parallel striae (grooves) running in various directions.

Some argue that the resemblances between the Miocene teeth in the museum collection and those of Megamouth are not enough of an indicator to assume a close relationship between the two. But it does seem tenable that both Megamouth and the fossil shark had a common ancestor among the lamnoid sharks, which are major predators.

It is generally agreed that Megamouth is a planktonivore (plankton eater); its long gill rakers betray this fact. The two largest extant sharks (basking sharks and whale sharks) and the largest ray are also planktonivores. But as the teeth of Megamouth illustrate, gill rakers were not always their primary food-gathering mechanism. Rather, filter feeders like Megamouth are specialized or degenerated from lamnoids. As they have evolved into planktonivores, their teeth have become smaller relative to the body and somewhat degenerate, a phenomenon also witnessed in bony fishes. Even greater reduction is seen in baleen whales; whale bone serves the function that gill rakers do in the fishes, and the adult baleen whale's teeth have completely disappeared.

The lineage of whale sharks (Rhincodontidae) provides a good example of what is probably happening in the Megamouth lineage. The geologically oldest fossils of whale sharks have teeth composed of a large central cusp with accessory cusps on either side and a bilobed root. But in the teeth of the living whale shark, there is only the single large cusp and a root.

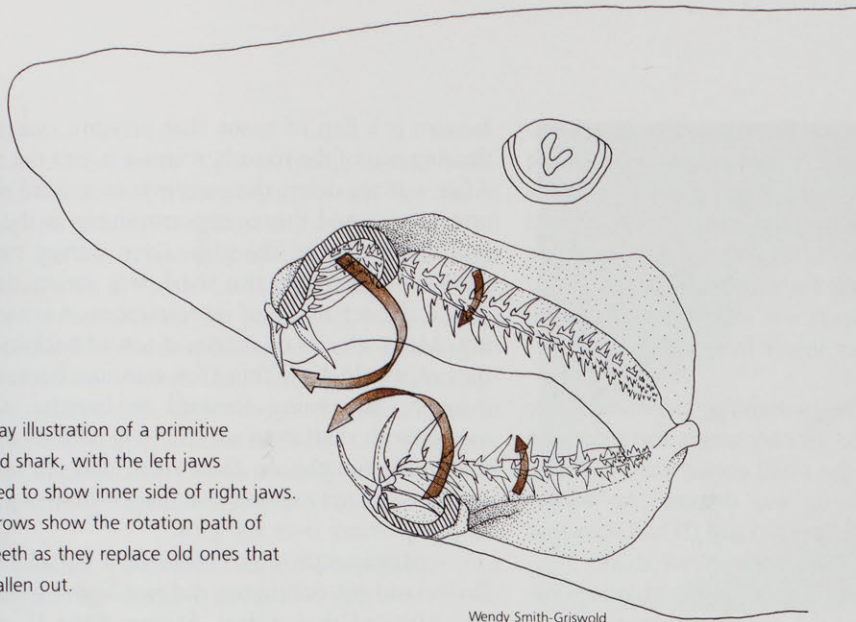
A generalized lamnoid shark tooth has a large principal cusp with at least one pair of accessory cusps and a root with two prominent lobes and a modest lingual projection, while almost all the Miocene megachasmid teeth have only a single accessory cusp on each side. In the living Megamouth, most teeth have no accessory cusps, although some have an accessory cusp on one side. A further comparison of generalized lamnoid shark teeth with the Miocene megachasmid and Megamouth shows that the lobes of the roots of the fossil teeth are less prominent than in the generalized lamnoid case, and the lingual bulge is prominent rather than modest. In Megamouth, the root is marginally bilobate, but the lingual bulge is still very prominent. This indicates that the Miocene teeth are morphologically intermediate between the generalized lamnoid condition and modern Megamouth.

A complicating factor in comparing the teeth is that only male Megamouth specimens are available for tooth samples. There is sexual differentiation in teeth of some sharks, but we do not know if this is the case with Megamouth.

The present is indeed the key to the past, and the discovery of Megamouth is an example not only of how museum fossil collections can tell us about living animals, but of how a living animal can provide the key to a paleontological mystery.

J.D. STEWART  
*Assistant Curator  
Vertebrate Paleontology*





Cutaway illustration of a primitive lamnoid shark, with the left jaws removed to show inner side of right jaws. The arrows show the rotation path of new teeth as they replace old ones that have fallen out.

RIGHT ►  
Megamouth II, showing vestigial condition of teeth.



### Tooth similarities between fossil sharks and Megamouth

|              | Characters                                                                                                                                                                       | Generalized Lamnoid Shark | Miocene Megachasmid | Megamouth (Megachasmidae) |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------|---------------------------|
|              | Length                                                                                                                                                                           |                           | 10-11 mm            | 13-14 mm                  |
| PROFILE VIEW | Crown (Lingual side is convex, Labial side is flat)<br><input checked="" type="checkbox"/> Bulge on lingual side of root                                                         |                           |                     |                           |
| LINGUAL VIEW | <input checked="" type="checkbox"/> Pointed, central cusp<br><input checked="" type="checkbox"/> Accessory cusp(s)<br><input checked="" type="checkbox"/> Wear facets and striae |                           |                     |                           |
| LABIAL VIEW  | <input checked="" type="checkbox"/> Bilobed root<br><input checked="" type="checkbox"/> Foramen in groove                                                                        |                           |                     |                           |

Wendy Smith-Griswold



shark's copulatory organ), but some resistance is encountered. Mating in sharks is a slow process, as the females seem to be uncooperative and the males overeager. The process results in the abrasion and bleeding of the claspers as they are thrust against the coarse, sharp skin of the female; therefore damage to Megamouth VI's claspers was assumed to be the result of normal use, not injury from being caught in a net.

Although a slow-swimming, large shark like Megamouth would be an easy target for a deepsea predatory shark like the small cookie-cutter sharks, *Isistius*, no such scarring was detected on Megamouth VI. Both Megamouths I and III had scars that could have resulted from cookie-cutter sharks.

Taylor and others (see references) have speculated that the lining of the mouth of Megamouth I may contain luminescent tissue, since they observed "... a bright silvery lining punctuated by small circular porelike structures." This presumed luminescence is thought to be associated with feeding. The Natural History Museum's Ichthyology Collections Manager Jeffrey A. Seigel and I described the mouth of Megamouth II, which had reflective tissue, but did not ascribe any light-producing tissues to it (TERRA Vol. 23, #4, March/April, 1985). Leonard Compagno, one of the original describers of megamouth, notes that Megamouth II may have had luminescent mouth tissue. During the evening of October 21, 1990, Megamouth VI was observed several times through the night and at no time was bioluminescence observed. Nor did anyone observe luminescence as we worked with him during the day. It could be that while confined in the harbor, he had no impetus to luminesce if the phenomenon is associated with feeding; or it may not have been detected. On the basis of observations of Megamouth VI, though, it seems doubtful that luminescent mouth tissue is present in megamouth sharks.

One of the most noteworthy discoveries we made regarding Megamouth VI was in regard to its respiration. For a period of almost eight hours, the shark was restrained by a large line wrapped about the base of its tail like a leash, and pulled steadily backwards. This wearisome, awkward journey covered a distance of more than 7 kilometers, and must have been fatiguing for the shark. The following day, Megamouth VI was again towed by its tail to a site about 2 kilometers offshore of Dana Point. During the entire period of transport, the respiration of Megamouth VI could be easily observed. Rhythmically the jaws opened slightly, never more than about 6 inches, as water flowed into its mouth. As the jaws opened, the gill-slits were pressed against the body, and probably were closed. Shortly thereafter, the mouth closed slightly and a frenum appeared. A

frenum is a flap of tissue that prevents water from flowing out of the mouth, routing it into the throat. After a short delay, the membranes around the gill openings would flutter uncontrollably as the water was expelled from the gills. Even during times of obvious distress, as the shark was being dragged about, the regularity of its respiration was astounding. Many species of sharks, if towed backwards by the tail, would die within a few minutes, because they must be swimming forward to breathe. Clearly megamouth sharks can survive long periods wherein they must breathe on their own, and are not ram respirers, which requires sustained swimming action to pump water over the gills.

Megamouth I ran afoul of a parachute, but Taylor and his colleagues did not know whether it had survived that ordeal. Megamouths II and VI survived entanglement in swordfish gill nets; Megamouth II was taken from a gill net and hauled from the water. Megamouths I and II probably could have survived their capture; Megamouth VI certainly did, and Megamouth II was in sufficiently good shape that survival was not out of the question, but it was removed from the water and died of suffocation. Based upon our experiences with Megamouth VI, we could assume that if entangled, these sharks have the potential to continue to respire at rates and for times sufficiently long to survive until released. Apparently ram swimming, which flushes water over the gills, is not the mechanism of respiration in megamouth sharks. Rather, respiration is achieved by the pumping action created by the opening and closing of the mouth and opercular cavities to push water over the gills.

Based on how they were found in the nets, it appears that some megamouth sharks seem to "kick back" and relax when entangled. Megamouths II and VI were recovered from about the middle of large-mesh gill nets that hung no deeper than 40 meters (130 feet). This is about the normal depth of the sharks at night. Both sharks were only slightly entangled in the gill nets, but neither of them had twisted or rolled in the net in an effort to escape — a curious finding. Most large animals that become entangled in gill nets attempt to escape, and only compound the problem. As the animal twists, increased layers of netting wrap tightly around it. Its jaws are restricted, water pumping stops, and the animal suffocates. This is not the case with megamouth. Why?

Megamouths II and VI were both mature males, and both appeared to have recently mated, based upon the condition of their claspers. Megamouth II was "running ripe," that is, spermatophores were oozing from the claspers. Megamouth VI was not running ripe, but the ends of the claspers gave evidence of recent use as they were extensively



abraded and bleeding.

As Megamouth VI was being hauled backwards in the waters, it occasionally would flex one of its claspers, holding it against the current for 15-20 seconds before relaxing. Since male megamouth sharks have the ability to hoist their claspers perpendicular to their bodies for prolonged periods, it is conceivable that the claspers could become entangled in the webbing of a net. Once entangled by its claspers, it would be difficult for the shark to free itself. In fact, the shark might relax and wait, as if it were mating. In this scenario, no twisting would occur, as the gill netting might be interpreted as a cooperative female.

Southern California might be a mating area for megamouth sharks in the fall. Megamouth II was taken in late November and Megamouth VI in late October, and both appeared to have recently mated. And additional evidence exists to support fall mating off southern California. The brilliant coloring of megamouth sharks suggests that they may be derived from an ancestry that inhabited shallow coastal or nearshore waters rather than from a deepsea animal. If so, then perhaps we might suspect that they return to these shallow depths to mate. What was the megamouth shark observed by Wendy Costello and Jim Lund doing on the surface? Mating? Resting after mating? The sex of that megamouth was not determined; thus we cannot be sure whether it was Megamouth VI or not. But this surface daytime observation could support an assumption of reproductive activity, particularly since Megamouth VI had such bruised and worn claspers.

Megamouth III, another mature male, was observed in nearshore waters off Perth, Western Australia, just prior to its demise in the surf. Could it have been in shallow water as a result of mating? Megamouth III represents the only southern hemisphere record, and it was not a fall capture. Four of the megamouth sightings have occurred in the fall; Megamouths III and V are the exceptions. Although it is unconfirmed, I suspect that Megamouth V was a female, on the basis of the four known photographs of it, in which no claspers could be detected. Based on the evidence that running-ripe males are known in the fall, it seems plausible that megamouth sharks mate in the fall and pup at some later date.

I am astounded that two captures have occurred off California in gill nets, in 1984 and 1990, but not before 1984. I suspect that they may have been caught before, even before 1976 (we are tracking down a purported 1971 catch off San Diego), and were not recognized as unique by their captors.

Our knowledge of the distribution of megamouth sharks remains scanty. All we know is that they have been caught in the western, central, and



Mark Dell'Aquila

eastern portions of the north Pacific. Apparently the north Pacific has been one of their habitats for some 26 million years as fossil teeth indicate (see box on page 35); only a single record of a living megamouth exists outside it. Are there perhaps isolated populations of megamouth sharks? The capture of Megamouth III in the Indian Ocean provides the only evidence to support this notion.

Are megamouth sharks tropical deepwater oceanic creatures as depicted by Taylor and his colleagues? It is curious that the Taylor article mentions that the stomach contents of the first megamouth included a euphausiid shrimp that is capable of making daily migrations between deep waters and the surface, but states that Megamouth I lived in a habitat where there is a relative paucity of nutrients and prey, i.e., it is a deepwater pelagic oceanic dweller. They did not mention the possibility that megamouth sharks might be vertical migrators. On the basis of the sea jellies and shrimp — typical inhabitants of the scattering layer — that were found in the stomach of Megamouth II, and its capture near the surface at night, Jeffery Seigel and I proposed that megamouth sharks were vertical migrators, and as more records of megamouths accumulated, this assumption was borne out. It became obvious that some individuals swam in nearshore waters well onto the continental shelf, and did not spend all of their time lounging about in nutrient-poor deep oceanic waters. But there was no empirical evidence of vertical migration. Megamouth VI would provide it; when we let him go, he would be wearing a pair of transmitters.

On the warm, sunny Sunday after his capture, an array of talented people helped prepare the gear necessary to study, photograph, and release Megamouth VI. My longtime colleague, underwater photographer Mark Dell'Aquila, assembled photo-

The belly of Megamouth VI showing the black-and-white-tipped pelvic fins and the large cylindrically-shaped claspers. Note that the tips of the claspers are red and abraded. The small anal fin can be seen just behind the claspers.



graphic gear. Jim McKibben, an expert on shark behavior who has designed electronic equipment to study them, took charge of obtaining and assembling sonic transmitters. Dr. Donald Nelson, a world-renowned specialist on sharks and their behavior, prepared the *R/V Discovery*, his personal research vessel, to track the animal once it was released. In less than 24 hours all was ready, and better yet, the shark was healthy and ready. About 11:30 a.m. on Monday, October 22, 1990, the *R/V Discovery* began to tow Megamouth VI from Dana Point Harbor to a location off the coast. Overhead, helicopters beat the air. Dana Point fishing boats, metamorphosed into observer vessels, carried loads of people curious to see the huge shark. With sustained regular breathing, flexing claspers, and pectoral fins flapping about clumsily, he withstood his humiliating journey. People watched anxiously; clearly, they wanted this shark to live. They saw him not as a fearsome and menacing threat, but as helpless and bound up. It was as if he were an aristocratic thoroughbred being treated in an undignified way.

Jim McKibben arranged for Mark Dell'Aquila to implant two sonic transmitters, one equipped with a depth sensor, in the back of Megamouth VI, alongside the large anterior dorsal fin. At about dusk, the tiny attachment darts of the transmitters knifed their way under the skin of his back. Within minutes, the line around his tail was loosened and he was released. He was impatient to leave and had been swimming steadily, maintaining a tension against the line. As Mark lifted the line over his tail, Megamouth VI gave two propulsive swings of his tail and dove towards the bottom at about a 70° angle. He made the journey from the surface to the bottom, about 43 meters (140 feet) from the surface, in about 10 seconds.

For about 10 minutes, he swam about just above the bottom, at a depth of 40 meters (130 feet). It was as if he was confused and was searching about to get his bearings. After this short period, he suddenly began to swim slowly offshore at about 0.95 kilometers per hour. He maintained this steady swimming rate during the entire time we tracked him.

Dusk had slowly melted into evening; it was dark. Like a small submarine, Megamouth VI was cruising along at 40 meters (130 feet). Without any warning, he began to ascend. Why? Was he returning to the surface to die? Slowly he continued to ascend until he was about 12.3 meters (40 feet) below the surface. He leveled off, and continued to journey south. All night long, he maintained the same depth and speed, progressing farther and farther from Dana Point, the place of his encounter with humans. Now he was well out to sea in ocean depths greater

than 923 meters (3,000 feet). At dawn, the expected happened. At first light, and without hesitation, Megamouth VI plunged into the depths. Within an hour, he had reached a depth of about 170 meters (553 feet), all the while continuing on a southerly path. Although he wandered about during the day, it was not aimlessly, because he maintained a relatively straight southerly trajectory. (Perhaps some of the wandering detected by the tracking instruments was feeding behavior, but this cannot be proven.) As dusk approached on Tuesday, October 23, Megamouth VI remained at about 170 meters. Then, as the sun set, he again began to ascend. His rise from the depths was as sharp and rapid as the morning dive into the depths. At darkness on the Tuesday evening following his release, Megamouth VI was again cruising along in shallow water near the surface. He performed the same migrations into the depths and rising again on Wednesday morning and evening.

Tracking was suspended on Wednesday evening, October 24, 1990, after Megamouth VI had been followed through two day/night cycles. (Documentation of the tracking record and vertical migratory pattern has been prepared by Donald Nelson and others for publication.) Here, then, was the evidence showing that megamouth sharks were indeed vertical migrators and occurred in depths corresponding to those of the deep scattering layer. Vertical migrators can escape detection, for they are in great depths during the day and near the surface only at night, when observation is difficult. Doubtless megamouth sharks were not detected prior to 1976 at least partly because of their vertical migratory behavior and the fact that driftnets only came into usage in the early 1970s. Why more of them have not been caught in nets, why so many have suddenly been seen in such a short period recently, and why they interrupt their vertical migratory behavior to lounge about on the surface — unless the latter is connected with mating — remain a mystery.

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Mark Dell'Aquila

A diver swims along the back of the 16' 1" long Megamouth VI. Note the black spots on the lower jaw and the distinctly black leading edge of the pectoral fins that give a whale-like appearance.



## Book Reviews

EXPLORING CULTURAL RESOURCES IN LOS ANGELES 1990 by Letitia Burns O'Connor, The Los Angeles Times. Paperback, 160 pages, \$14.95.

A COUPLE OF YEARS AGO, a group from Inner Mongolia arrived in Los Angeles to visit with me and my family for about a week. Early on the morning after their arrival, I met them at their hotel, bundled them into a rented van, and drove onto the Golden State Freeway, headed for Disneyland. During the fits and starts of traffic congestion and the mad accelerations to top speed, I briefed them on what they could expect when we arrived: the lines, the need to stay together, the food, and the nature of the attractions. On our arrival, I hustled them toward what was then the newest and most exciting "ride" at

Disneyland: Star Tours. Since we were early, the boarding of the starship went swiftly. With no

time for reflection, we were strapped into our seats and began our launch into hyperspace.

For me, it was a fun trip, but my Mongolian friends were frightened half to death. Visiting the U.S. for the first time, still suffering from jet lag, and not adjusted to the hectic pace of life in Los Angeles, my visitors half-fearing that they really were being launched into hyperspace.

In retrospect, I should have scheduled some more relaxing activities to begin their stay, before plunging them into an exhausting, all-day excursion to never-neverland. But I realized that, although I had lived in Los Angeles for more than a decade, I didn't really know much about local resources other than the obvious ones like Disneyland.

Now that I have learned my lesson, I am glad to have also found the book to help me plan these itineraries in a lower key. The book, *Exploring Cultural Resources in Los Angeles* by Letitia Burns O'Connor, is published by the Los Angeles Times and is a guide that pulls together well-mapped information about the cultural institutions, museums, parks, educational resources and outdoor venues in the Los Angeles region. Conspicuous by their absence from this book are Disneyland, Knott's Berry Farm, Magic Mountain, and other large tourist attractions outside the geographical range of the book.

O'Connor sets out explicitly to provide "a new view of the city's diversity and vitality." To accomplish this end, she breaks the Los Angeles area into ten regions between Malibu and Long Beach. Each region comprises one of the book's ten chapters. Each chapter is introduced by a map that shows where the resources are located in relation to major thoroughfares. In each chapter are also numerous local and institution maps.

The itineraries that O'Connor sets out in the chapters are arranged so that everyone can find places close to home that are in-

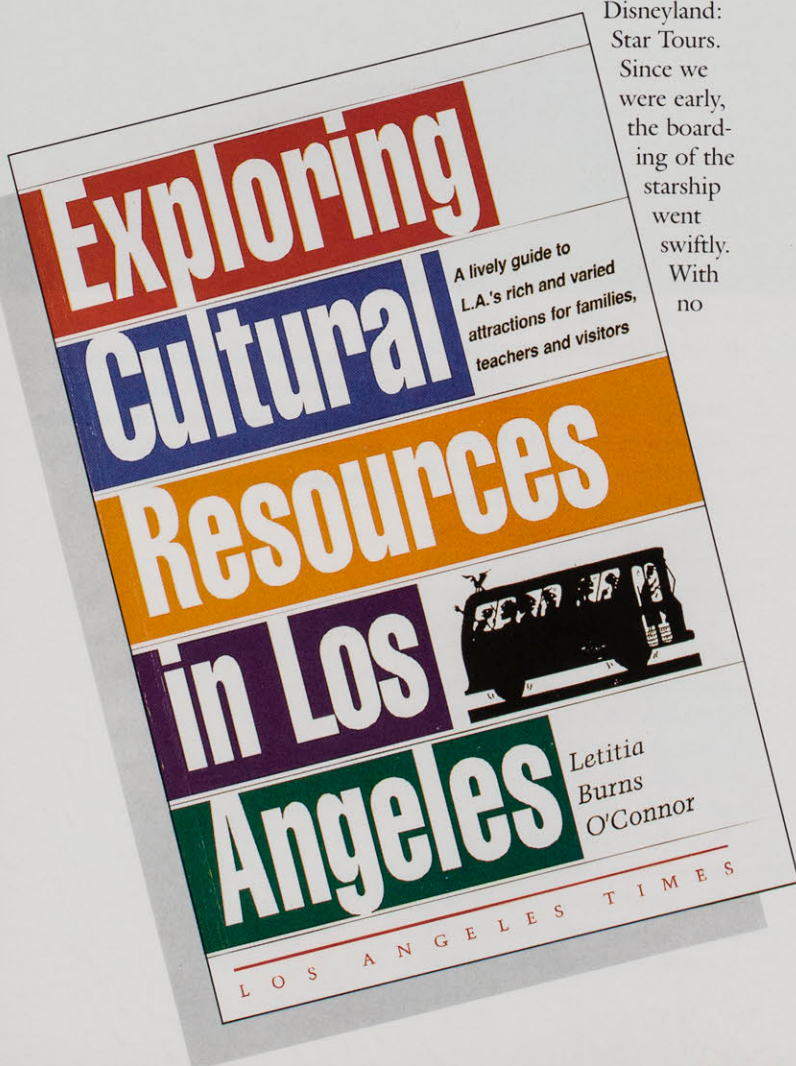
teresting, diverting and informative as well as relaxing. My own tours of Los Angeles, especially for foreign visitors, can now begin near my home, for example, in the restful atmosphere of Pasadena's stately old neighborhoods.

The most appealing aspect of the book is its orientation to educational resources, not just cultural monuments. In planning excursions like the ones I often devise or in organizing family weekends, the extensive program listings can profitably be used by singles, couples and families alike. The book lists places that provide programs or exhibitions tailored for specific learning objectives; for parents who want a strong educational component included in their outings with their children, these are indispensable (some even provide complete lesson plans.) Parents can find summer programs and extracurricular enrichment courses for themselves and their children alike.

A very useful feature of the book are appendices that detail educational programs available for school-age children and teens, summer youth programs, and outdoor activities such as hike and bike trails, nature centers, beaches, wilderness clubs, and stargazing and whale-watching opportunities. It is worth buying just for the convenience of having the vital statistics of museums, parks, tours, observatories, etc. in one place. It even tells whether sites have a bookstore or shop on the premises.

After reading this book, I realize how easy it is to plan an itinerary here, both for formal visitors and for weekends with my children or visiting family. As the author points out, it is actually possible to tour the freeway-afflicted city of Los Angeles on foot — if you cut it up into the appropriate pieces.

GARY SEAMAN  
Professor of Anthropology  
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# House Calls

**Q:** The Los Angeles Times recently ran an article about the violin spider. Are they really dangerous?

**A:** In early April, local newspapers reported an infestation of "violin spiders" discovered by county health officials in numerous buildings in the downtown Los Angeles area. The Brown Recluse is a species of violin spider whose bite may cause serious wounds. The public is justifiably alarmed, and is raising questions about how much these spiders should be feared and how to identify them.

Dr. Charles L. Hogue, Curator of Insects, echoes the warnings of the health authorities for proper respect for a venomous species, but points out that the species found downtown is a shy spider that has never been reported to have bitten anyone.

Violin spiders, so called because of a violin-shaped dark marking on the back (neck of violin pointing rearward), are recognized by the scruffy webs they

construct in dark corners of woodpiles, under stones, and indoors among stored refuse, clothing etc. The spiders themselves are yellowish-brown, with small bodies in proportion to their long, slender legs. They are medium sized; the leg spread of a mature female would just extend beyond the edges of a quarter. Other common innocuous local spiders meet this description, but none have the unique arrangements of eyes of violin spiders: six of them arranged in three close-set pairs. This can be seen with a 10X power hand lens or microscope.

Violin spiders belong to their own family, Loxoscelidae, and belong to the genus *Loxosceles*. The species found downtown and in the San Gabriel Valley in 1969 is *Loxosceles laeta*, an immigrant from South America. The Brown Recluse, or *Loxosceles reclusa*, is from the eastern U.S. and is rare here. We have a native species, *Loxosceles unicolor*, which is much smaller and less venomous than the others.

A watercolor rendering of *Loxosceles laeta*. The violin shape has been darkened to exaggerate its outline, which is actually much fainter.

Mary Butler

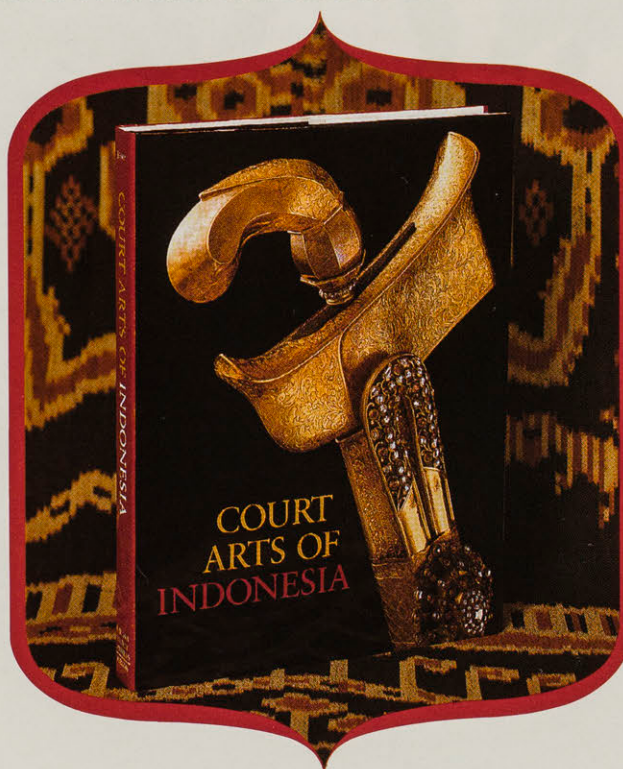


# COURT ARTS OF INDONESIA EXHIBITION

October 19, 1991 through January 5, 1992

## FIND INDONESIAN DECOR IN THE GALLERY STORE

In conjunction with this major exhibition, the Gallery Shop abounds with the art and craft of Indonesia. You'll find beautiful woven textiles, fine basketry, carved wooden masks, shadow puppets, and traditional jewelry. Also choose from a wide selection of book titles on Indonesian art and culture.

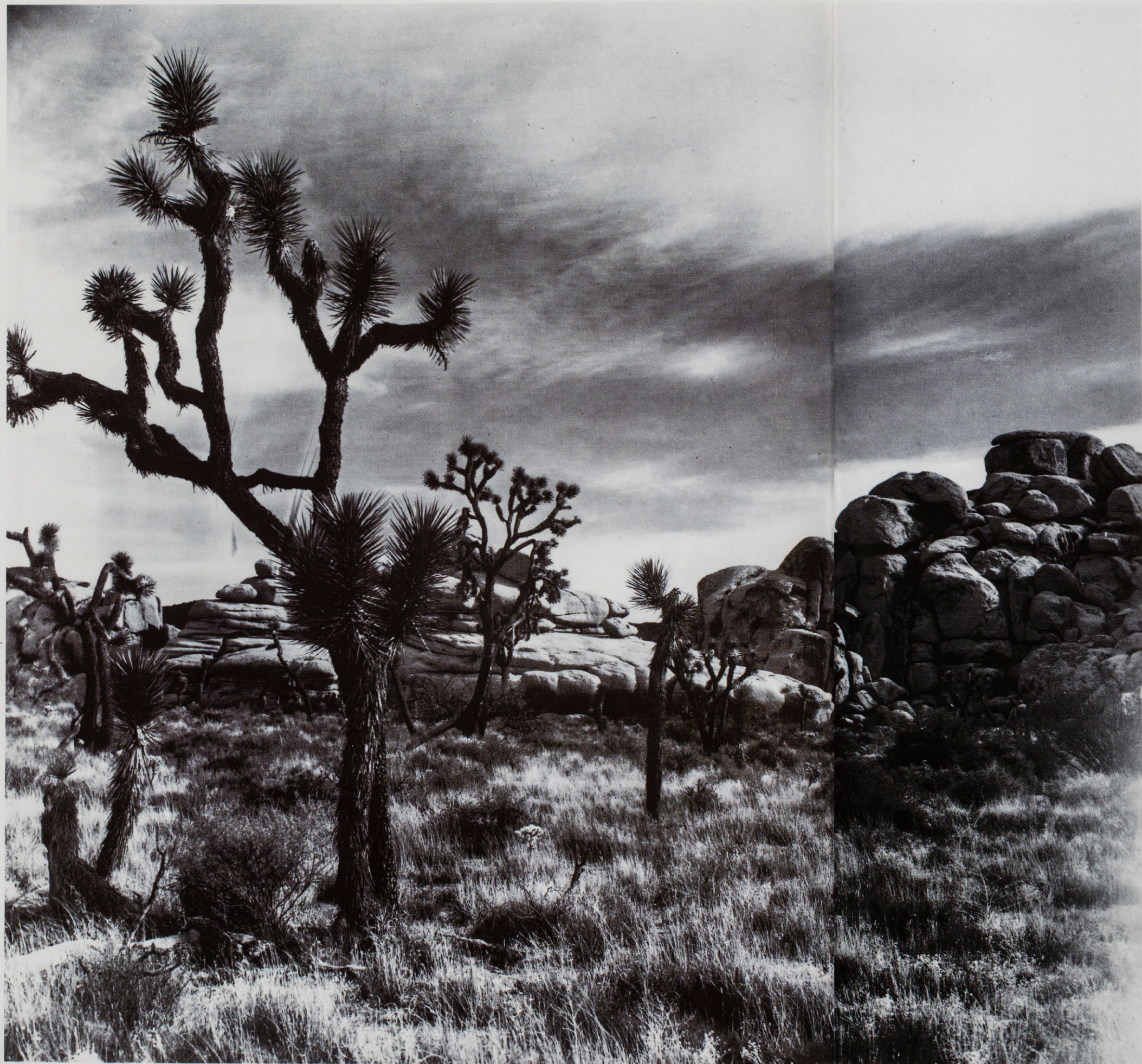


## EXHIBITION CATALOG

A beautiful 288-page catalog, *Court Arts of Indonesia*, accompanies the exhibition. This book, like the exhibit, focuses on the numerous royal courts that once governed the vast archipelago that comprises the world's fifth largest country. More than 200 illustrations, including 140 plates in full color, reveal treasured objects of the court tradition from the eighth century C.E. to the present and from every region of Indonesia's territory. Included are dazzling jewelry, gem-studded ritual vessels, stage crowns set with diamonds, traditional textiles, regalia, sculptures, musical instruments, manuscripts, masks, shadow puppets, and many outstanding examples of the *kris*, the legendary daggerlike weapon that epitomizes Indonesia's famed metalwork. An entire chapter is devoted to court architecture, possibly the highest manifestation of Indonesian culture.

*Court Arts of Indonesia* may be purchased in the Gallery Store, or by calling the Museum Bookstore at 213/744-3434. Hardcover: \$65.00. Softcover: \$45.00.





Green Collection Seaver Center

## Focus on the West

**I**N THE LATE 1920s SOUTH PASADENA conservationist Minerva Hamilton Hoyt began to lobby for creation of a national desert park. Mrs. Hoyt, a Mississippi native who first viewed California's deserts through the window of a Pullman car, made frequent visits to the desert by horseback and became increasingly alarmed at the urbanization that took place there with the ascendancy of the automobile. Health and resort communities sprang up, and cactus gardens became the rage both there and in nearby cities. The collection of mature desert plants for their exotic value in urban gardens became epidemic. Particularly endangered was the Joshua tree yucca, whose eccentric branching was highly prized by collectors.

Mrs. Hoyt spent the years between 1926 and 1930 accumulating support from activists and scientists to form the International Deserts Conservation League, which sought to preserve desert environments in four California counties. In August of 1930 she personally championed a 1,000,000-acre region of the Mojave Desert, an area that contained juniper and Joshua tree forests, for a national desert park.

National Park Service Director Horace M. Albright was sympathetic to Mrs. Hoyt's proposal, but he said that the Park Service simply could not support it. Two other proposals — Death Valley and a saguaro cactus reserve near Tucson — were already under consideration, he said, and a third request would be too much.

Not one to be deterred, Mrs. Hoyt wrote to President-elect Franklin D. Roosevelt with her plan, and in 1933 traveled to Washington to present her case to Roosevelt's new Secretary of the Interior, Harold Ickes. Finally, after battles with developers, politicians in Washington and California, railroad officials, and National Park Service supervisors, Mrs. Hoyt saw the Joshua Tree National Monument created by Roosevelt in August of 1936 as a Scientific Area under the provisions of the Antiquities Act of 1906. The mandate for the 557,000-acre site, about 140 miles east of Los Angeles, called specifically for the conservation of unique desert portions of Riverside and San Bernardino Counties.

Mrs. Hoyt's accomplishment heralded a changing American attitude that has today blossomed into a full-scale desert conservationist movement. Deserts are now perceived as something worth preserving rather than as just obstacles to cross or wastelands to reclaim.

The Seaver Center has a number of photos of national parks and monuments in its general photo collections.

*M. GUY BISHOP  
Assistant Curator  
Seaver Center for Western History Research*

Joshua Trees, Joshua Tree National Monument.



# Southland Diorama

## LACE LICHEN

ONE OF THE MOST INTERESTING and diverse groups of fungi is the lichens. Over 16,000 species have been described from around the world, many living in areas where other plant life is unable to exist. Lichen species are true pioneers of nature, creating conditions for other plants to eventually take hold. They can grow on the ground, on trees as epiphytes (plants that grow on other plants) or on tree bark, and on the surface of rocks. Over long periods of time, their acids dissolve rock and break it down into soil, paving the way for other organisms to grow.

A lichen is the association of an alga and a fungus in which the two organisms are so intertwined that they form a single thallus (the main body of the organism). It was not until the second half of the 19th century that this dual nature was understood; for a long time it was believed that they were an independent group of lower plants.

Different theories have been proposed about the association of the two organisms. One holds that it is a truly symbiotic one in which the fungus derives sustenance from the algal cells and the alga in return

is protected from adverse conditions by the fungus. An alternate view is that a host-parasite relationship is formed in which the fungus is partially parasitic and allows most of the algal host cells to survive. A more middle-of-the-road approach is that there is a symbiotic relationship, but the fungus essentially imprisons the alga, thus allowing the fungus to play the dominant role.

Lichens are found on all sorts of substrates, often growing under extremely brutal conditions. The red-orange *Xanthoria elegans* is found on rocks and has adapted to a harsh existence — fluctuating extremes of temperature, scarcity of water, and exposure to the sun. Colonies of this lichen develop very slowly and may live for a very long period of time.

One of the most interesting species found in Southern California is the lace lichen (*Ramalina menziesii*). This species is epiphytic and is the largest lichen known in North America. Some specimens can be up to nine inches wide and as much as six feet long. Usually it is found festooning oaks, but it occurs on several other kinds of trees as well. Its morphology is highly variable, determined largely by its

*Xanthoria elegans*





LIVING WAS NEVER MORE REWARDING!



Mike Meeker

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See page 4 for details.





Lace Lichen (*Ramalina menziesii*)

Robert Gustafson

proximity to the coast where fog, wind, and salt spray are important factors. It is extremely hygroscopic — capable of absorbing large quantities of water — and this increases its mass considerably.

Lace lichen is an excellent indicator of air pollution. Specimens from the Natural History Museum's botany collections show that this species was once found in the Santa Monica Mountains on live oaks; today it has totally disappeared from the Los Angeles area. A few years ago, experimental transplants of healthy specimens from Santa Barbara County to the Santa Monica Mountains were made. The lichens showed signs of chlorosis; in less than 3 months, they yellowed and died. Chlorosis in a lichen is attributable to airborne contaminants, particularly heavy concentrations of sulphur dioxide.

The museum's botany section curates over 20,000 lichen specimens from around the world. One of the first and most important donations was made by H.E. Hasse at the turn of the century. His collection of several hundred specimens from the Los Angeles area was the basis for his publication *The Lichens of Southern California*. Attempts to locate many of these species have proved futile, once again an indication that air quality has seriously declined in the last 100 years.

All over the world, lichen species are disappearing from large industrial cities. Holdings such as the Hasse collection serve as an important resource for documenting the continuing deterioration of our natural heritage.

ROBERT GUSTAFSON  
Collections Manager, Botany

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Retrace the routes of polar explorers and discover the world's last unspoiled wilderness aboard the "Society Explorer." Visit rookeries of chinstrap, macaroni and Adélie penguins and watch bellowing seals close at hand during Antarctica's austral summer.

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**\$TBA.**



# YOUR VIEW TO THE WORLD

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**\$TBA.**



ERIC HOVANITZ

MAYA COAST

For further information,  
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(213) 744-3350



ERIC HOVANITZ

COPPER CANYON







# We're taking you to court.



Photo: John Gollings © The Asia Society

*Shadow puppet, mid-19th century. On loan from Mangkunagaran Palace, Surakarta, Java.*

## COURT ARTS OF INDONESIA October 19, 1991–January 5, 1992

Discover the wealth of treasures from the royal courts of Indonesia. Shadow puppets, court regalia, manuscripts and dance masks are just a few of the rich variety of items that will be on display. The Court Arts of Indonesia is an international loan exhibition that includes over 160 works of art dating from the 8th to the 20th century. The objects were selected from private collections and institutions in Indonesia, Europe, Australia and the United States. This extraordinary exhibit has been made possible by a generous grant from the Texaco Foundation.

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